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PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES
AND IMPROVEMENTS

IN THE
MEDICAL AND SURGICAL SCIENCES

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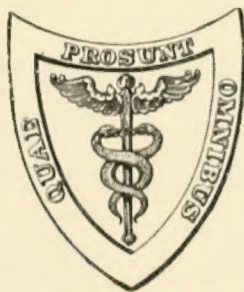
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VOLUME I. MARCH, 1917

SURGERY OF THE HEAD AND NECK—SURGERY OF THE THORAX, EXCLUDING DISEASES
OF THE BREAST—INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM,
CROUPOUS PNEUMONIA, AND INFLUENZA—DISEASES OF CHILDREN
—RHINOLOGY, LARYNGOLOGY AND OTOTOLOGY



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PROGRESSIVE MEDICINE.

MARCH, 1917.

SURGERY OF THE HEAD AND NECK.

By CHARLES H. FRAZIER, M.D.

THE BRAIN.

The Pineal Body. Each year sees a slight advance in our knowledge of the pineal body in health and disease. It is necessarily a slow process, however, partly because of the lack of unity of the results thus far obtained in the experimental laboratory, and partly because of the few opportunities of carefully observing the clinical course of pineal lesions and of confirming the diagnosis by operation or autopsy. Our present knowledge would seem to indicate that the gland becomes functionally inactive at the time of puberty and that any pathological changes or extirpation of the gland before this time tend to produce precocious somatic and sexual development. It would seem, therefore, that the prime function of the gland during its period of physiological activity is to inhibit sexual, and possibly mental, development. The experiments of Sarteschi, and those of Foá upon hens and rats, which have been previously reviewed,¹ are in accord with this theory. The results of pinealectomy have been negative in a number of instances, however (Exner and Boese, Dandy), and some of the feeding experiments which we have previously reviewed (Dana and Berkeley, McCord and others) have accelerated, rather than retarded, sexual and somatic development. We are therefore somewhat at a loss when we attempt to draw definite conclusions as to the functions of this small organ.

During the past year an important contribution has been made by Horrax.² As the result of a large series of pinealectomies in guinea-pigs and rats, Horrax has come to the following conclusions: (1) Total experimental pinealectomy is possible in guinea-pigs and rats. (2) Pinealectomized male guinea-pigs show a hastened development of the

¹ PROGRESSIVE MEDICINE, March, 1914, p. 21.

² Archives of Internal Medicine, 1916, xvii, 606-625.

sexual organs, manifested before maturity by a relative increase in size and weight, both of the testes and seminal vesicles, over control pigs of the same litter. (3) Histologically, the testes and seminal vesicles of these animals, if taken before the age of sexual maturity, show a more advanced physiological state than their controls. (4) The pinealectomized females appear to show a tendency to breed earlier than controls of the same age and weight. (5) For several reasons, young rats are likely to prove better subjects for experimental pinealectomy than young guinea-pigs, and some evidence of hastened maturity has been obtained in this species.

The guinea-pigs operated upon ranged from two days to seven weeks in age. The technic was as follows: A median-line incision was made over the posterior aspect of the skull, the periosteum scraped back with a blunt knife and a chip taken out of the underlying bone down to the dura. The opening was then enlarged until the superior longitudinal sinus was exposed from its midpoint to its junction with the two lateral sinuses. The removal of the larger part of the occipital bone afforded ample exposure of the pineal region. The superior longitudinal sinus was then ligated in two places anterior to the two lateral sinuses and divided with the dura between the ligatures. Upon retracting the posterior flap of dura thus formed, the pineal was exposed, grasped with a "mosquito" clamp, and extracted. Great care was necessary to control the subsequent hemorrhage. Control animals were kept under exactly the same conditions, and both sets were sacrificed from seven to fourteen weeks after operation. Careful histological examinations were made of the genital organs and the other endocrine glands. The average weight of the testes of the experimental pigs was almost 200 mg. more than that of the controls, and, microscopically, the tubules were found to be much larger and spermatogenesis more active. Marked differences were also observed in the seminal vesicles, which showed enlarged lumina completely filled by secretion of colloid material. There were no demonstrable differences in the genital organs of the pinealectomized females. By comparing the dates of parturition in the experimental pigs and the controls, it was found to be one-sixth to one-third earlier in the former. In order to eliminate the possibility of the pituitary playing a part in these changes, that organ was examined microscopically in the entire series and no change from the normal was demonstrated. The researches of Horrax furnish further evidence in favor of the direct relation between the sexual glands and the pineal during its period of physiological activity.

The clinical data now available would seem to indicate that the pineal body exerts an inhibitory influence upon sexual and mental development. In most cases of tumor of the pineal, in addition to the general symptoms, such as increased intracranial pressure and those due to pressure on the corpora quadrigemina, oculomotor paralyses and pupil-

lary disturbances, and those due to pressure upon the cerebellum, such as ataxia, we find certain constitutional changes which must be inherent in the abnormal condition of the gland itself. These are often described as "macrogenitosomia precox," a syndrome consisting in abnormal somatic and sexual development and mental precocity. Horrax¹ has described three cases of pineal tumors which have been observed in the surgical service at the Peter Bent Brigham Hospital during the past two years. In two cases the diagnosis has never been absolutely confirmed, as the patients are still living, but the clinical pictures were strongly in favor of disorder of the pineal. In one case, a girl, aged eleven years, there was general bodily overgrowth, her height being 152 cm. and her weight 52.3 kg., and precocious adolescence, her general development corresponding to that of a girl of sixteen years. The röntgenogram showed a hydrocephalic skull, definite enlargement of the sella turcica and a shadow in the region of the pineal, possibly due to a calcium deposit. Her condition remained unchanged after puncture of the corpus callosum. I have had under observation a case quite parallel to this, in which the existence of pineal symptoms and an associated hydrocephalus were the conspicuous features. The case will be reported more at length in course of time. Suffice it to say now that puncture of the corpus callosum relieved the headache and arrested the papilledema. Two courses of radium treatment were given, and after the lapse of a few months there was a gradual subsidence of symptoms, and at this writing there is every reason to believe the child is on the road to complete recovery. In the second case, reported by Horrax, a boy, aged seven and a half years, there was also abnormal somatic development, precocious adolescence, and epileptic seizures; there was, however, no adiposity. Upon exploring the right hemisphere the dura appeared normal, with no signs of increased tension, the arachnoid was grayish and thickened, and by pricking the membrane a large amount of fluid was milked, probably from an old meningo-encephalitis. In the third case, a boy, aged twelve years, necropsy revealed a struma of the pineal. The most pronounced symptoms in this case were those of a general nature, such as headache, nausea, vomiting, vertigo, blurred vision, choked disk and diplopia, followed later by a right-sided convulsion and aphasia. Fluid obtained by ventricular puncture showed marked xanthochromia. In addition, there were certain signs indicative of an infectious process, particularly a chronic nasal catarrh, transient deafness, cervical rigidity and positive Kernig's sign. There was also bodily overgrowth and precocious adolescence, but no adiposity. Indeed, there seems to be a diversity of opinion as to the cause of adiposity in these cases. Some claim that it is due to a diminution of function, while others, particularly Marburg, attribute it to hyperpinealism. It is doubtful whether "hyperpinealism

¹ Loc. cit., p. 626.

in man ever causes adiposity *per se*," since there may be metabolic or chemical changes in the pituitary or other glands which cannot be demonstrated even by histological examinations. Cushing believes it is due to secondary changes in the hypophysis, probably caused by the accompanying hydrocephalus.

The pathological physiology of the pineal seems to be in quite as chaotic a condition as that of the pituitary, and it is still difficult to say whether certain tumors be due to hyper- or hypofunction. In these cases the cells showed "an extreme rapidity of growth, indicating an active formative faculty which is usually associated with a loss of specific function." If this struma have caused a diminution of function of the pineal, the cases are quite in accord with the physiological observations of Foá and of Horrax on their pinealectomized animals. It is, however, difficult to make these facts coincide with the feeding experiments which have been carried on recently. The question is therefore worthy of further investigation. Pineal tumors may be rare, but they are probably much more common than was hitherto supposed, and they should always be borne in mind when, in addition to symptoms of increased intracranial pressure, we have signs of precocious mental, sexual and somatic development.

The Hypophysis. That defective functioning of one of the internal secreting glands may be compensated for by the administration of the extract of that gland is by no means a new observation; the application of this principle has been applied for some time in cases of thyroid and adrenal insufficiency. Indeed, many laboratory investigations have been made as to the effect of extracts of the pituitary body, both from the whole gland and its separate divisions, and pituitary extract has been administered in a considerable number of cases of pituitary disorder; but the results of pituitary feeding, both in the laboratory and in the clinic, have been so varied that its value as a pharmaceutical agent has never been definitely established. This may be attributed in part to the difficulty of correctly correlating the clinical picture with the underlying pathological changes, and in part to the lack of data on the effects of experimentally induced hyperfunction of the pituitary body.

Heretofore, studies on the results of pituitary feeding in animals have been limited almost entirely, with the exception of some work by Behrenroth, to its effects upon growth and metabolism, and have left out of consideration its influence upon the other members of the endocrine system, particularly the genital organs. This is a most important phase of the subject, because the polyglandular phenomena often play a large part in the syndrome accompanying pituitary disorders. An important contribution has been made in this direction during the past year by Goetsch.¹ The basis of his studies is a series of pituitary feeding

¹ Johns Hopkins Hospital Bulletin, 1916, xxvii, 29.

experiments upon young rats over periods varying from twelve days to six or eight months. Dried powdered extract of bovine anterior and posterior lobe was used, both separately and in combination, and controls from the same litter were kept under exactly the same conditions. In the beginning, 0.1 gm. of the extract was given, but later this was decreased to 0.05 gm. At the end of the experiments careful examinations, both macroscopic and microscopic, were made of all the ductless glands, special attention being paid to the genital organs. The ovaries, tubes and cornua of the uterus of the animals fed with whole gland extract were larger and more vascular than those of the controls. The ovary was matured and showed active ovulation and Graafian-follicle formation two months earlier than under normal circumstances; there was also marked hyperplasia of the uterine mucosa. In the male, the testis showed abnormal development, as was evidenced by the extremely active spermatogenesis. The animals fed with whole gland extract also showed certain symptoms, such as increase in weight and coarser growth of hair due to the effect of the anterior lobe, and other changes, such as loss of appetite, increased peristalsis, mild enteritis, and some nervous phenomena, particularly muscular tremors and weakness of the hind limbs, which were attributed to the influence of the posterior lobe. Feeding with anterior lobe alone was followed by increase in weight and somatic development generally, and abnormal and precocious development of both the primary and secondary genital organs. These animals bred earlier and more often than the controls, and the number of offspring in the litters was greater. On the contrary, feeding with the posterior lobe alone caused no stimulation of growth or sexual development; in fact, Goetsch found there was a less marked development of the sex glands after administration of posterior lobe for seven and a half months than after anterior lobe for two and a half months. Large doses of the posterior lobe extract resulted in loss of weight, mild enteritis and increased intestinal peristalsis. These experiments have led Goetsch to believe that the posterior lobe element in the whole gland extract markedly retards sexual development, as was evidenced by a case in which the testis was still incompletely developed after eight and a half months of feeding with posterior lobe extract.

The question arises as to how we are to apply these results to organotherapy. The present stage of our knowledge of disorders of the pituitary body seems to indicate that in most instances both the anterior and the posterior lobes are involved. For example, we often have combined in the same case a tendency toward adiposity and various changes in metabolism, such as an increased tolerance for carbohydrates, which are to be attributed to deficiency of the posterior lobe, and, on the other hand, certain skeletal changes and genital disturbances due to the perverted function of the anterior lobe. The lesion may have been situated primarily in the anterior lobe and affected the posterior lobe only secondarily

through pressure, or the reverse condition may have occurred. The lesion in the anterior lobe may have begun as a hyperplasia, and later this portion of the gland may have undergone involution and become inactive. In the early stages of pituitary disorders we frequently have acromegalic symptoms and abnormal development of the genitalia, to be followed later by genital atrophy. The latter condition is quite in accord with the results of removal of the anterior lobe in animals. Whether the genital hypoplasia present in some of these cases is to be attributed in any way to deficiency of the posterior lobe and pars intermedia, as Biedl believes, is still a matter of dispute. It is very difficult to determine on clinical and pathological grounds, because in the same case it is very likely that in the early stages there was a hyperplasia of the anterior lobe, causing a deficiency of the posterior lobe through pressure, followed later by atrophy of the anterior lobe. Goetsch's experiments would seem to indicate quite definitely that posterior lobe extract, which also includes extract from the pars intermedia, has a distinctly retarding influence upon genital development.

Be this as it may, I feel convinced that in the majority of instances the best results are to be obtained by administration of extract from the whole gland, since in almost every case there are certain symptoms which can be influenced by the anterior lobe only, and others which will respond only to the active elements from the posterior lobe. We must proceed very cautiously, however, in all organotherapy. Each case must be considered as a distinct and separate problem. Feeding with the whole gland extract or anterior lobe alone may have harmful results when the symptoms are caused only by hyperfunction of the anterior lobe. It may be that posterior lobe extract alone will prove useful in such cases. Glandular feeding should ever be borne in mind, and in all cases in which the symptoms point to glandular insufficiency—that is, when there is genital hypoplasia, increased tolerance for carbohydrates, adiposity and general underdevelopment—it seems to me that organotherapy should be applied conscientiously, either as a measure supplemental to surgical intervention, or, in cases in which operation is not indicated, as the chief means of restoring the lost balance in the endocrine system.

In a recent paper Miller¹ states that it is only the extracts of the posterior lobe which are therapeutically active; in fact, that the active substance is contained only in the pars intermedia. Haynes² has recently reported a case in which he has used extract from the pars intermedia alone with marked success. In his case the child presented characteristic symptoms of thyroid insufficiency at three years of age and was immediately put upon increasing doses of thyroid extract. When twelve years of age, definite acromegalic symptoms appeared; her weight increased abnormally, her face appeared heavy, and her fingers became

¹ American Journal of Medical Sciences, 1916, clii, 549-560.

² American Journal of Children's Diseases, 1915, x, 331-343.

broad and blunt; her skin was rough, and she was irritable and dull. The röntgenogram showed an enlarged sella turcica. Since it was found there was a marked increase in her tolerance for glucose, Haynes concluded there was a hyperplasia of the pars anterior which, through pressure, caused a deficiency in the secretion of the pars intermedia. The child was then given capsules prepared from the pars intermedia of bullocks, and there was almost immediate improvement in the texture of her skin, in the contour of her hands, face, and feet. The effect upon her mentality was no less marked; she became much brighter, her disposition improved, and she began to take an interest in her surroundings. The pars intermedia capsules were continued for a year, accompanied some of the time by a little thyroid. Whether equally good results could have been obtained by feeding with whole gland or posterior lobe extract is difficult to say. If it be the secretion from the pars intermedia which is the active substance, certainly better results should be obtained from concentrated extract of the pars intermedia rather than from extract containing both pars anterior and posterior. I very much question Goetsch's¹ recommendation that carbohydrate tolerance may be used as an index to anterior lobe insufficiency and "thus be a guide to the dosage to be used in our gland therapy," since clinical and experimental evidence would seem to indicate that changes in carbohydrate tolerance are to be attributed to perversion in the function of the posterior lobe only.

A new substance known as "*tethelin*" has recently been prepared by Robertson,² of the University of California, and used in a series of experiments on white mice. This substance was made by the addition of one and a half volumes of ether to a concentrated alcoholic extract of the dried anterior lobe of ox pituitaries, and was called tethelin from the Greek, meaning *growing*, because its administration to mice was accompanied by the same effects upon their growth as that produced by the administration of the whole tissue of the anterior lobe, namely, retardation during the first portion of the third growth cycle followed by acceleration during the latter portion of the third growth cycle. When tethelin was fed to adult animals they became more compact in form and build, and they also did not display the same belligerency which was exhibited by animals fed with the whole lobe tissue. The important point, however, was the fact that there was no diuresis or changes in blood-pressure such as follow the administration of the whole gland or posterior lobe extract.

Most of what we know of the physiology of the pituitary body has been gleaned either from experimental extirpation of the gland or from the administration of glandular extracts. Another method was introduced a few years ago by Weed, Cushing and Jacobson,³ namely the

¹ Loc. cit.

² Journal of Biological Chemistry, 1916, xxiv, 385.

³ Bulletin of Johns Hopkins Hospital, 1913, xxiv, 40.

effect produced by stimulation of the superior cervical sympathetic ganglion on the secretory discharge of the pituitary. Further investigations along these lines have been reported recently by Shamoff,¹ who has found not only that stimulation of the superior cervical sympathetic ganglion produced glycosuria, even when the nervous connections between the abdominal viscera and the stimulated ganglion were entirely severed, as his predecessors had, but that it also led to a discharge of hypophyseal secretion which produced diuresis as well. In most of his experiments the spinal cord was severed at the fourth thoracic segment and both vagosympathetic nerves divided. That the diuresis was due to hypophyseal secretion alone Shamoff upholds on the grounds that after cutting off all nerve impulses from the stimulated ganglion down to the kidneys there seemed to be only one way of increasing their activity, namely, "through the blood by the diuretic hormone of the posterior lobe." This belief was further confirmed by the character of the hemodynamic response and the polyuria following stimulation of the ganglion. A few investigators, particularly Camus and Roussy, have claimed an encephalic origin for polyuria and related phenomena, but most observations are in accord with the results of Shamoff, namely, that they are due to a disturbance of secretion of the pituitary body.

Another contribution has been made during the past year regarding the *effect of castration on the pituitary.* Livingston,² in a series of experiments on rabbits found that neither males nor females showed a constant hypophyseal hypertrophy following castration or spaying. In each series there was, however, a constant relationship between the rate of increase in body weight and the response of the hypophysis to castration or spaying, there being less hypertrophy of the hypophysis in those cases which showed an increase in rate of growth.

Of the specimens removed from the hypophysis at operation the adenoma seems to be the most frequent. In a series of 64 cases collected by Cope,³ in which the pathological diagnosis was given, 45 were classed as adenomata, the most common benign tumor of the thyroid, which, like the anterior lobe of the pituitary, is an outgrowth of the primitive pharynx. Seven, or 11 per cent., were cysts, often filled with yellow fluid containing cholesterin crystals. It seems not improbable that some of these cysts are due to a complete degeneration of a previous adenoma; indeed, in one of Hirsch's cases the fluid contained some eosinophilous hypophyseal cells. Occasional cases of endotheliomata, teratomata, mixed tumors, and sarcomata are reported. While malignant growths of the pituitary are comparatively infrequent, this gland is sometimes the seat of metastasis.

In a case of carcinoma of the thyroid gland reported by Hammond⁴

¹ American Journal of Physiology, 1916, xxxix, 279.

² Ibid., xl, 153.

³ British Journal of Surgery, 1916, iv, 107.

⁴ Cleveland Medical Journal, 1916, xv, 225.

there were certain ocular symptoms, such as hemianopsia, corneal anesthesia, and ophthalmoplegia suggestive of pituitary involvement, and the autopsy showed the sella turcica to be filled with a tumor mass about 5 cm. in transverse diameter, inseparable from the pituitary and pressing against the third and fourth cranial nerves and the first division of the fifth. The growth proved to be a cuboidal-celled carcinoma, and there were no other deposits within the cranial cavity. It has been suggested several times that diabetes insipidus in cancer of the breast is due to a metastasis to the hypophysis. Sekiguchi¹ has recently examined the hypophysis in 35 cases of cancer of the breast which came to autopsy and found metastasis in 2 cases. In both of these cases the patients had suffered from marked polyuria shortly before death. Since no pathological changes could be demonstrated in the kidney or elsewhere in the brain, Sekiguchi concluded that the hypophyseal disturbance probably had a direct bearing on the polyuria. In each case the lesion was limited to the posterior lobe of the pituitary, and this in accord with Schaefer's theory that a tumor of the pars posterior may, through pressure, cause a hypersecretion of the pars intermedia, which, as recent research would lead us to believe, is intimately connected with the function of the kidneys.

Changes in the contour of the sella, as demonstrated by the röntgenogram, tell us whether the growth is intra- or extrasellar, whether the sphenoid sinuses have been encroached upon—a very important prognostic point—and whether the lesion is of long or short duration. Cope classifies abnormal sellæ as follows: (1) Enlarged fossæ with contour not deformed; (2) fossæ smaller than usual; (3) deformed fossæ. As causes for enlargement of the sella we have adenomatous changes in the gland itself; malignant growths originating in the fossæ, and occasionally, in cases of insufficiency of other members of the endocrine system, for example, in the cretin, a compensatory enlargement of the pituitary. Abnormally small sellæ are usually to be attributed to glandular insufficiency, while deformed sellæ, as Cope says, are caused either by tumors bursting from within or by interpeduncular neoplasms pressing down from above, and I might add hydrocephalus.

The paramount indication for surgical intervention, in addition to the symptoms of increased intracranial pressure, is threatened loss of vision. The latter implies usually that the tumor has projected beyond the bounds of the sellæ into the cranial cavity, hence, as Cope says, all pituitary tumors which come to operation for symptoms other than acromegaly have long before burst the bounds of the fossa. Cope,² in his recent monograph on the surgery of the pituitary fossa, states that there are two operations which have proved fairly satisfactory for approaching the pituitary fossa, the Hirsch-Cushing submucous nasal

¹ *Annals of Surgery*, 1916, lxiii, 297.

² *Loc. cit.*

method and the fronto-orbital method of Frazier. The reviewer was once of the opinion that the transphenoidal route should be given preference in the majority of instances, but with riper experience and with the opportunity to study the late results of the transphenoidal route, he has come to the conclusion that the transfrontal approach offers the best opportunity for a more radical removal of the growth, and, as a result, ensures more enduring results. The very fact that in many cases the sella has already encroached upon all the available space of the sphenoid sinus, leaves little to be hoped for in the way of relief solely from the effects of a sellar decompression. The latter has been dwelt upon forcefully by the advocates of the transphenoidal method. My original technic for the transfrontal method has been modified and simplified, and at the same time offers increased opportunity for inspection and for radical extraction of the growth. Consequently, I believe that method will grow in favor as the only way in which a clear and unobstructed view of the lesion may be obtained. It is, furthermore, a procedure in which the danger of infection and meningitis, so threatening in the nasal route, may be dismissed from one's mind. Furthermore, the operative mortality compares favorably with the transphenoidal route. I have had no fatalities in the transfrontal operation for removing pituitary lesions, losing one patient in which this technic was employed for an extrasellar tumor at the base of the anterior fossa. Cope has estimated the mortality of the various procedures by various operators as follows:

Schloffer method	26	per cent.
Endonasal method	9	"
Transfrontal method	8.6	"

In the March, 1916, number of PROGRESSIVE MEDICINE I discussed the relative merits of the two approved methods of reaching the pituitary, the transfrontal and transphenoidal routes. Though it is not possible yet to decide finally between these, the opinion can be expressed that the fronto-orbital route is more suitable in the great majority of cases. Cope feels, since the general intracranial pressure is more easily relieved by the fronto-orbital method and a growth removed from the immediate neighborhood, that this operation is likely to have the advantage. He has employed the fronto-orbital technic in three cases—in one case an endothelioma was exposed and partially removed, in another a cyst was evacuated, while in the third there was no evidence of tumor. While some improvement followed in the first two cases, it is too soon to speak of the final results; the third died six months after the operation, but no autopsy was obtained.

In a case operated upon by Ruth¹ by the transfrontal route, there was

¹ Journal of Iowa State Medical Society, 1916, vi, 343.

considerable improvement in the contour of the face and other acromegalic symptoms, as well as the general symptoms, five months after the operation. Ruth's technic differs from mine in that the upper portion of the supra-orbital ridge is removed with the rest of the osteoplastic flap. In all other respects his procedure is quite similar.

In a paper by my former assistant, L. H. Landon,¹ the technic which he employed, during his term of service in my clinic, for reaching the pituitary body by the trans-sphenoidal route is described as follows:

The operation is performed with the patient sitting. Local anesthesia is used throughout in the majority of cases. Morphine sulphate, gr. $\frac{1}{6}$, and atropine sulphate, gr. $\frac{1}{50}$, are given hypodermically a half-hour before operating. The exposed portions of the face and nares are painted with 5 per cent. tincture of iodine, after which both sides of the septum in their entirety are anesthetized with a 10 per cent. solution of cocaine in 1 to 1000 adrenalin chloride. Contact for fifteen minutes is usually sufficient to secure anesthesia lasting from an hour and a half to two hours. The protective hood is now lowered over the head, leaving only the tip of the nose and nares exposed. As an additional precaution, 1 to 2 c.c. of a 0.5 per cent. novocaine solution in 1 to 1000 adrenalin are injected hypomucously just prior to making the initial incision. This serves the double purpose of inducing anesthesia and of mechanically raising the mucoperichondrium, thereby making the subsequent steps of the operation much easier. A submucous resection of the septum now follows, care being taken to avoid perforations of the mucous membrane, and hence communication with the general nasal cavities except at the primary incision. The rostrum of the vomer is used as a guide to the sphenoid sinus, the antero-inferior wall of which it forms. When the rostrum is reached the mucoperiosteum is separated laterally on the two sides until the ostia are seen. The sinus is now opened, either by punch or by deliberately cleaving away the vomer with a chisel. Up to this point the operation is done by reflected light from a head mirror. A modified Killian speculum carrying an incandescent light at its tip is now introduced between the layers of mucous membrane. This two-bladed speculum is of specially heavy construction, is self-retaining, and when opened the turbinates are flattened out on either side to the full capacity of the nose, exposing the sinus to its lateral walls. Through this speculum and under direct illumination, the operation is completed. If the sphenoid septum be present, it is broken down and the bulging prominence of the sella floor indentified. The latter is broken through with a chisel and the opening enlarged as far as possible in all directions. In many cases the bony floor is of the thinness of paper from pressure atrophy and its removal is extremely easy, or it may be lacking altogether and the sinus occupied by the growth. If the sellar contents be under

¹ Pennsylvania Medical Journal, 1916, xix, 675-679.

pressure, they will prolapse to a greater or lesser extent through the opening. The capsule of the gland is now slit by a crucial incision and its contents exposed. The dura may, or may not, be opened. If so, there is an immediate escape of cerebrospinal fluid, but this has never resulted in a permanent fistula. The almost complete absence of hemorrhage is remarkable. When the gland or growth is incised, it may for the moment be considerable, but is always controlled by adrenalin. At the conclusion of the operation, the speculum is removed and the mucous walls fall together. One or two stitches are placed in the incision to prevent retraction and seal the wound. The nasal cavities are packed with bismuth-albolene gauze, which is allowed to remain for twenty-four hours. The operation may have to be done in two stages, if difficulties are encountered in the first stage, if there is any doubt as to the accuracy of approach to the sella, and if the condition of the patient demands it.

Brain Tumor.—An analysis of a series of 70 cases of brain tumors has recently been made by Heuer and Dandy,¹ in which 71 major operations were performed upon 62 patients; of the 62 operative cases there were 6 deaths between twenty-four hours and five days after the operation, an operative mortality of 8.6 per cent., a case mortality of 9.6 per cent.; 2 patients died later in the hospital, so that the total mortality was 11 per cent. and 12.8 per cent., respectively; 15 patients left the hospital apparently well, 29 greatly improved, and 11 unimproved. Of 33 cases in which the lesion was revealed at operation, complete removal was attempted in 28; in 7 extirpation was only partial, and in 4 the size or location made any attempt at removal unwise. Of the remaining 29 cases, simple decompression, or an exploratory craniotomy combined with the decompression, was performed in 21, cerebellar exploration and decompression in 13, the mortality of this group being 14 per cent.

Of the 42 cases in which the lesions were revealed at operation or autopsy, the cerebral hemispheres, midbrain, and hypophysis were involved in 30 cases; the cerebellum or paracerebellar region in 12. Of the 20 gliomata, all were comparatively large, varying in consistency from relatively hard to extremely soft, gelatinous growths; 11 were diffuse.

Heuer and Dandy find that the intratracheal insufflation method of administering ether gives a smooth, even anesthesia, without cyanosis, straining, or coughing. Personally, I see no reason for using the intratracheal or, as it should be called, endotracheal method, except in the subtentorial cases. Here there are very good reasons for its adoption. But in pretentorial lesions the endopharyngeal method meets every indication and should be given preference. In the one case in which Heuer and Dandy used local anesthesia, the exploratory craniotomy for

¹ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 224.

a subcortical cerebral lesion was performed with almost no pain. I quite agree with them that the two-stage operation is seldom necessary and that the added danger of infection, hernia, and the effects of the second anesthesia should condemn it except when hemorrhage or the condition of the patient demands it.

For the control of hemorrhage from the scalp I have abandoned every form of tourniquet, or other device, for the hemostatic forceps. For operations in the temporal region, Heuer and Dandy elevate the temporal muscle from the base of the flap at the beginning of the operation and place a temporary clamp, resembling a stomach clamp, across the scalp and muscle. To relieve intracranial pressure, when extreme, Heuer and Dandy prefer the ventricular puncture before the dura is opened, tapping the posterior cornu of the lateral ventricle. Personally, I prefer to empty the ventricles by puncture of the corpus callosum or by lumbar puncture after the dura is open. This can be done in my operating chair without changing the position of the patient.

While a large proportion of brain tumors are malignant, they are not prone to metastasize. Thus, when the difficulties of localization and approach are finally overcome, the results of operation upon brain tumors should be much better than those upon similar lesions elsewhere in the body. Complete removal is possible in about 10 per cent., but it is also true, as Heuer and Dandy put it, that every operation may be converted into a palliative procedure, and in 50 per cent. of all cases we may undoubtedly expect an amelioration or total disappearance of pressure-symptoms and a subsequent comfortable existence. I cannot subscribe to their policy of attempted radical extirpation of gliomata, for, while the immediate results may be satisfactory, they will find from their end-results that incomplete removal offers no advantages to the patient over a simple palliative operation. On the other hand, endotheliomata are much more favorable for radical treatment, although the operative mortality may be high for those situated in the cerebellopontile region. In the latter location, local recurrence is not infrequent if the base of the tumor be not removed. While cysts are, surgically, the most favorable lesion, there is always a tendency to refill with the return of symptoms unless the cyst wall be excised.

Brain Puncture. Brain puncture has not been mentioned in *PROGRESSIVE MEDICINE* for some time, principally because there was little new either from the stand-point of technic or clinical results. However, in view of the fact that several very excellent reviews of the subject have recently appeared by Pincus,¹ by Röper,² by Haasler,³ and by Axhausen,⁴ it seems but wise to turn our attention once more to the

¹ Diagnostische u. therapeutische Ergebnisse d. Hirnpunktion, Berlin, 1916.

² Centralb. f. d. Grenzgeb. d. Med. u. Chir., 1915, xviii, 1.

³ Die allgemeine Chir. d. Gehirnkrankheiten, Krause, 1914, II, Teil.

⁴ Ergeb. d. Chir. u. Orthop., vii, 330.

consideration of the various aspects of this procedure about which our German colleagues are still so enthusiastic. While various attempts have been made ever since 1856 to prove, both experimentally and clinically, the efficacy of brain puncture, notably by Middeldorpf, Maass, Spitzka, Schmidt, Payr, and Souchon, it remained for Neisser and Pollack, in 1904, to place the procedure on a firm foundation.

The technic finally elaborated by Neisser and Pollack, as the result of careful anatomical studies, has been but slightly modified up to the present time, with the exception of various methods which have been devised to obviate the difficulty experienced in finding the hole made in the skull through which the cannula is to be inserted. Unger's method of placing a thin metal tube over the neck of the borer and gently pushing this into the opening in the skull before the borer is withdrawn did not prove satisfactory and was discarded by Neisser. In *PROGRESSIVE MEDICINE*, March, 1912, we described Borchardt's technic for fixation of the scalp on the skull. A somewhat simpler method has been devised by Goetze,¹ who replaced the flat borer which had been in use up to that time by a gimlet borer with a fine groove down its entire shaft, and a relatively smaller point than the flat borer. When the desired opening had been made in the skull a heavy steel bristle is introduced along the groove into the interior of the skull, the borer withdrawn, and the cannula gently shoved over the bristle into the interior. Goetze has found this procedure, which is very simple and requires the assistance of only one person to hold the head, most satisfactory, particularly in the cerebellar region, where the greatest difficulty is usually experienced. Goetze's modification of the original technic has been accepted by Neisser and is used in his clinic. Axhausen² recommends the use of a very firm-pointed, steel mandarin, which he has found of great use in place of Goetze's blunt one. Payr,³ who found that Goetze's mandarin did not permit sufficiently free movement of the needle, has conceived a slightly different way of overcoming the difficulty by means of a small, narrow sound, with a vertical grooved end, one-half inch long, which he inserts into the opening before the borer is withdrawn. The introduction of the cannula along this grooved surface through the opening into the interior is thus very simple. Payr has applied this method over a dozen times and has experienced no difficulties. Röper⁴ reports that he found Payr's device most satisfactory in several cases, and, according to Stertz,⁵ the Payr sound has been adopted at the Breslau Klinik. Without having had experience with either the Goetze or the Payr method, it is difficult to speak authoritatively as to their relative merits. We will not here dwell upon the appropriate points for puncture and the other details in the technic, as these have been carefully described in the original

¹ Deutsch. med. Wehnschr., xxxviii, 318.

² Loc. cit.

³ Zentralb. f. Chir., 1913, xl, 386.

⁴ Loc. cit.

⁵ Ztschr. f. d. ges. Neurol. u. Psych., 1913, xxi, 319.

articles by Neisser and Pollack, which have been previously reviewed and are fully discussed in the three more recent reviews referred to above, but will turn at once to the application of brain puncture for diagnostic and therapeutic purposes.

In addition to the experience of Neisser and Pollack, Ascoli, Weintraud, Schultze, Wernicke, Acholz, Oppenheim, Borchardt, Förster and many others have reported concerning the *diagnostic value of brain puncture*. It has been used both for purposes of diagnosis and localization in cases of suspected brain tumor and cysts, in cases of hydrocephalus and serous meningitis, intracranial hemorrhage, abscess and purulent meningitis with varying degrees of success. In many cases the diagnosis thus made has been confirmed at operation or at autopsy. It appears to have been of greatest diagnostic value in cases of intracranial hemorrhage; according to Axhausen, many lives have been saved by the prompt operation thus made possible, and the procedure should receive wide recognition and application. In 15 cases collected by Pincus¹ in which a puncture was performed, the puncture led to a mistaken diagnosis in 3 cases, while in the remaining 12 cases the intracranial presence of blood was confirmed. Whether it be possible by means of brain puncture to ascertain the type of the hemorrhage or hematoma, that is, whether it be epidural or subdural, is still an open question. The data in the reported cases is not sufficient to determine this fact. It may be, as Pincus suggests, that occasionally we may be able to tell when the sharp-pointed needle is piercing the dura, or it may be possible to use a blunt cannula until the dura is reached and then insert the pointed cannula in just the same place.

The value of *brain puncture for the diagnosis of various pathological conditions of the meninges* seems to be pretty well established. Axhausen emphasizes particularly its use in traumatic edema of the pia. In the few cases of meningeal cyst in which it has been applied it has also been of value. The measure has been used a number of times for the diagnosis of brain abscess and purulent meningitis. Pincus has collected 5 cases of brain abscess in which puncture was performed. In 3 cases there was a diffuse suppurative meningitis, with suggestion of abscess; in 1, a localized brain abscess. In the 5 cases the diagnosis wavered between cerebellar tumor and a meningitis serosa. In 3 cases of supposed purulent meningitis, brain puncture was of little value. In 1, a suspected "cerebellar abscess" by puncture was found at autopsy to be a diffuse suppurative meningitis; in the other 2 cases the puncture was negative.

While brain puncture can be of little use, either as a diagnostic or therapeutic measure, in cases of *hydrocephalus* and *serous meningitis*, it may, if associated with ventricular puncture, bring a certain amount

¹ Loc. cit.

of temporary relief. Puncture of the corpus callosum, however, is supplanting ventricular puncture, since permanent drainage for the cerebrospinal fluid from the lateral ventricle into the subarachnoid space is thereby obtained.

Whether brain puncture can be a help for purposes of diagnosis and localization in cases of suspected brain tumors and cysts is a somewhat disputed point. In these conditions, according to Axhausen, it should not be looked upon as an entirely harmless procedure. Small hemorrhages caused thereby lead to exacerbation of already existing symptoms. This measure should therefore be limited to those cases in which the symptoms are not sufficiently clear to warrant operation. Under these circumstances it has been very effective in a number of cases by making an earlier operation possible. Through brain puncture it is often possible to recognize an accompanying internal hydrocephalus and to determine its relation to the tumor. In addition to the light which it throws on the location of the lesion, it may also reveal the pathological character if sufficient tissue be removed for examination.

Brain puncture has a certain, but very limited, *therapeutic application*. Axhausen's experience indicates that it is effective in cases of *epidural hemorrhage* only under the most desperate circumstances until the operation can be performed. On the other hand, in cases of *subdural hematoma*, brain puncture is considered very effective as a therapeutic measure and should be more widely recognized. It has not yet been applied therapeutically in cases of *meningeal cyst*, and its use is now universally condemned in cases of *brain abscess* and *brain tumors* (Pincus, Axhausen and others). Thus, while it is claimed that brain puncture has certain restricted therapeutic applications, it should be looked upon principally as a diagnostic measure, and even for this purpose as a not entirely harmless procedure. The chief complications, aside from sudden decrease in pressure in badly selected cases, are hemorrhage and infection.

Stertz¹ considers the danger of hemorrhage slight if one avoid the meningeal artery and the sinus. Without personal experience with this procedure it is difficult to estimate just how serious a factor hemorrhage is. After a careful survey of all the literature on the subject, Pincus concludes there is danger of injuring both arteries and veins in spite of the utmost care and the most intimate knowledge of the anatomical and topographical relations. As regards infection, there is always a possibility of the development of a meningo-encephalitis if the needle be passed through infected tissue.

I leave to the reader to discover between the good and the evil of brain puncture. The opinions above expressed as to the advantages of the procedure are from those who have used it more or less extensively. When there is a suspicion of hemorrhage, abscess, or tumor sufficiently

¹ Loc. cit.

grounded to justify brain puncture, I should always favor an exploratory operation. Were the findings of brain puncture uniformly accurate, it would appeal to me with greater force, but the uncertainty, the possibility of error, combined with that of more or less serious consequences, are such that I have not been disposed to accept it as a useful and advantageous diagnostic procedure.

Hydrocephalus. While some attempts have been made to differentiate between the various types of hydrocephalus upon the basis of the underlying etiological factors, little that is new has been brought forth from the stand-point of treatment, and the results from the previous methods are but little more encouraging. In previous numbers of *PROGRESSIVE MEDICINE* we have described Haynes' cisterna-sinus drainage for those cases of hydrocephalus in which there is obstruction of the exits of the fourth ventricle, with consequent distention, and have gone over the results of its application, which have been for the most part discouraging.

Haynes¹ has recently published 12 cases in which he applied this technic; 5 of the patients died while in the hospital—3 from shock, 1 on the operating table, 1 an hour after operation, and 1 on the third day; 1 from bronchopneumonia on the fifth day, and 1 on the sixth day. Of the 7 discharged from the hospital, 1 lived eighteen months with apparent arrest of the hydrocephalus, but died finally of "summer complaint." Another died one month after operation from an attack of gastro-intestinal disturbance; the head, however, was much improved. In a third case the drainage ceased and the disease returned at the end of one month. In a fourth there was considerable improvement, but the child died two months later from fever and diarrhea. The fifth was discharged in "fine condition," but could not be traced. The sixth case was "very much improved physically and mentally" three months after operation. In the seventh there was a recurrence of the disease at the end of two months and the child was readmitted for a second operation, which was followed by slight, if any, improvement.

These results are by no means encouraging. Haynes believes the operation has a firm physiological foundation and that it is a comparatively simple procedure. He states, however, "I am still in the mood to question the permanent results in *any given case after any operation*, my own not excepted." Practically every child with hydrocephalus is abnormal in other respects besides its brain, and these defects would usually be unaffected even though the hydrocephalus could be controlled.

Since the normal mode of escape for the cerebrospinal fluid is *via* the blood stream, principally through the superior longitudinal sinus, Haynes² believes that the most logical treatment for those cases of hydrocephalus in which the obstruction is in, or above, the aqueduct of

¹ New York State Journal of Medicine, 1916, xvi, 174-181.

² *Loc. cit.*

Sylvius is drainage into the superior longitudinal sinus. Payr¹ devised a method of drainage into this sinus by means of a piece of vein. His technic, however, was complicated and the method never proved satisfactory.

Haynes has elaborated a somewhat simpler procedure on the same principle, which, however, has not yet been tried upon the living subject. The technic is as follows: To the right side of the median line in the region of the anterior fontanelle a flap is turned down one and a half by two inches, with its base toward the right, exposing the brain for about an inch. With an obtuse-pointed spinal needle the thickness of the cerebral cortex is ascertained at about an inch from the sinus. The superior longitudinal sinus is then incised at a point half an inch in front of the place selected to penetrate the ventricle, and this is done obliquely in the direction of the long axis of the tube when in its permanent position in order to imitate the opening of the veins into the sinus against the blood stream. A rubber tube with a diameter of 2 or 3 mm. should be previously prepared by cutting one end obliquely and threading a suture through it, the other end being cut more obtusely and fenestrated near the end. The tube and the sutures used with it are sterilized by boiling in vaseline. This tube is then fastened in position in the sinus, and the place where it is to be passed through the dura into the ventricle is surrounded by a silk suture, the dura incised, and the free end of the tube passed along a grooved director into the ventricle. The tube should be allowed to project slightly into the ventricle. The incision about the tube is then closed by tying the suture in the dura. Whether this will prove a feasible method remains to be seen.

Cerebrospinal Fluid. Since the cerebrospinal fluid plays such an important part in many of the problems arising in cranial surgery, it seems fitting that we should keep closely in touch with the investigations concerning its secretion, absorption and functions. During the past year, Dixon and Halliburton² have published the results of their further *investigations regarding the circulation and absorption of the fluid*. Their conclusions are similar to those reached by Peet and myself in our experiments, namely, that substances introduced into the cerebrospinal fluid do not find exit by the lymph channels but appear rapidly in the blood, the rate of their appearance in the blood depending upon the diffusibility of the substances. The transference takes place by a process of diffusion which is most rapid in the subcerebellar region and very slow in the lower spinal. They believe that it probably occurs into the venous sinuses by way of the arachnoidal villi described by Weed, but their experiments do not exclude the possibility of partial transference through the walls of the bloodvessels by a process of osmosis as upheld by Mott. This they believe is also the course of the normal

¹ PROGRESSIVE MEDICINE, March, 1912, p. 28.

² Journal of Physiology, 1916, 1, 198-216.

cerebrospinal fluid. Their experiments show, further, that substances injected into the cerebrospinal fluid do not appear in the blood, a fact which further confirms the investigations of Goldmann, Peet and myself and others, that the choroid gland acts as a limiting membrane and protects the tissues of the central nervous system from harmful substances.

Some further investigations as to the absorption of the cerebrospinal fluid have recently been made by Browning,¹ who divides the efferents for the fluid from the subarachnoid space into two general classes: The animal or quadruped type and the human. The former consists of minute channels or cells (perhaps comparable to lymphatics) that lead from the spinal subarachnoid space along the nerves to the extraspinal tissues. In the human being these spinal outlets exist *only during fetal life*, being demonstrable up to the time of birth at full term. Browning came to this conclusion by a series of injections in the human subject ranging from the sixth month of intra-uterine life up to sixty-nine years of age. A few short stumps remain after birth, but these soon disappear; hence, there must be some other form of outlet for the fluid.

The injection experiments by various workers have demonstrated that the cerebrospinal fluid passes by way of the Pacchionian bodies into the parasinual spaces and finally into the veins and sinuses. Those granulations, Browning found, are not present in animals, with the exception of the monkey, or in the human fetus. They develop only after birth and increase gradually with the years. If these granulations be the chief means of escape of the fluid after birth, there is a period immediately following birth when the efferent system for the spinal fluid must be very limited. This theory is quite in accord with the greater frequency of hydrocephalus in the newborn and in childhood, and its comparative rarity after maturity when the Pacchionian system has become effective.

Intracranial and Intraventricular Injections of Remedial Agents. The tendency of modern medicine is toward direct, rather than indirect, methods of treatment, and this is particularly true in the treatment of *cerebrospinal syphilis*. The ineffectiveness of subcutaneous and intravenous injections of serum to combat the cerebrospinal symptoms of syphilis has been recognized for some time and the necessity of introducing the medication directly into the central nervous system is now most earnestly emphasized by all those who have had large experience in treating these cases. This may be accomplished by means of intraspinal injections, as first advocated by Swift and Ellis, by intracranial injections into the subdural or subarachnoid spaces, according to Levaditi, Marie and de Martel, Marinesco and Minea, and Sicard,² or by injections directly into the lateral ventricles, as advocated by Ballance. The time has come when we must select from these the most effective way of

¹ Medical Record, 1916, lxxxix, 959-960.

² PROGRESSIVE MEDICINE, March, 1915, p. 49.

dealing with cerebral syphilis. With this end in view several series of investigations have recently been pursued, notably by Shoenberg,¹ who proceeded by the *intra vitam* staining method in a series of dogs and rabbits to ascertain by which route substances reached the interstices of the cerebral cortex, and particularly the optic nerve, most quickly and satisfactorily. In the twelve animals which received intraspinal injections, the meninges of the spinal cord, cerebellum, and medulla were more or less stained, but the cerebral cortex and optic nerves remained unstained. His experience with intracranial subdural injections was very similar to that of Ballance, namely, that the fluid could not be injected in any appreciable amount, and that in dogs the staining fluid did not reach the optic nerves. The intraventricular injections gave by far the best results; in all animals the meninges of the entire brain, spinal cord, and optic nerves were intensely stained. It would therefore seem that substances should be introduced through the ventricles or the cranial subarachnoid space if the cerebral hemispheres and the optic nerves are to be satisfactorily reached.

The experience of Sharpe and Hammond² are quite in accord with this view. Sharpe has injected salvarsan directly into the lateral ventricle seven times, according to the following technic: Under ether anesthesia a small skin flap, slightly larger than the trephine used, is made a little in front of the bregma and 2.5 cm. from the sagittal sinus. A button of bone 1.5 cm. in diameter is removed and the dura incised. The slender cannula, with blunt point, is introduced at a point free from underlying cortical vessels and passed downward and a little backward into the lateral ventricle. The head of the table is lowered and from 10 to 30 c.c. of fluid allowed to escape. The head of the table is now raised and a funnel containing the serum is attached to the cannula by short rubber tubing. The fluid enters entirely by gravity and is slowly introduced. The cannula is then withdrawn and the scalp wound sutured. In the second, and subsequent, injections, the scalp over the trephine opening is infiltrated with novocaine and the ventricular injection is carried out as described above. As the brain is not sensitive, a general anesthetic is not required in second injections. The injection might be accomplished by callosal puncture, Sharpe suggests, but there is always a possibility of wounding the sinus or one of the small pial veins, and he believes, as Ballance does, that a trephine opening is best, and I am quite in accord with this opinion. It would also never be possible to repeat the callosal puncture under local anesthesia because of the extreme sensitiveness of the falx. In a series of experiments carried out by the department of physiological surgery of the New York University and Bellevue Medical College, it was found, in the brains injected subdurally, that the meninges of the injected side were deeply stained, but the corresponding cortex

¹ Journal of American Medical Association, 1916, lxvi, 2054-2060.

² Ibid., 1915, lxv, 2147-2150.

was only slightly tinged and there was no penetration of the loose tissues lining the sulci, and no stain was demonstrable in the ventricles. In brains injected intraventricularly, the stain was found to be well distributed through the meninges and cortex of both hemispheres, including the prolongations into the sulci, and the ventricles, cerebellum, and base of the brain and even the spinal cord were deeply stained.

Wardner¹ has reported his results in 14 cases in which salvarsanized serum was injected into the cranial subdural space. His technic is as follows: The serum is prepared according to the Swift-Ellis method. Then, under ether anesthesia, a small skin flap is turned back in the anterior temporal region well above the ear and a trephine hole about 1 cm. in diameter bored in the skull by means of a Hudson drill. A lumbar puncture is then made and about 30 to 40 c.c. of fluid withdrawn. A bent salvarsan needle is then carefully pushed through the dura and 40 to 50 c.c. of the serum allowed to flow in by gravity. The injection may be repeated on the opposite side in two weeks and subsequent applications may be made at intervals of two weeks, the same trephine hole being used for the injection. From four to eight injections were given in each case, and in the total number of 102 operations there were no untoward effects. Both mental and physical improvement was noted in most cases after the second or third injection.

That in some cases both intraspinal and intracranial injections may be indicated is borne out by the results in a case reported by Gordon.² After several intraspinal injections, the cord symptoms were markedly improved but the cerebral symptoms remained unaffected; the latter, however, cleared up immediately after intracranial injection of the serum.

Meningitis. Signal advances have been made in the *treatment* of certain types of the infectious meningitides, particularly the meningococcic, through the introduction of serum therapy; nevertheless there are many cases which are uninfluenced, and, after a protracted and chronic course, finally terminate fatally. This may be due in some instances to a mistaken bacteriological diagnosis; for example, the anti-meningococcic serum would be of little avail in combating staphylococcic, streptococcic, or even parameningococcic infection, and the clinical pictures are often very similar. However, with the progress which has been made in bacteriology and serology, the possibility of such errors is becoming more and more remote. It is far more likely that the serum, for one reason or another, has failed to reach the central focus of infection. Indeed, this has been found to be the case in a number of recent autopsy examinations, and these cases bring home more forcibly than ever the great need of determining, as accurately as possible, the exact cause, nature, and location of the inflammatory product, whether it be in the nature of a serous meningitis or of the purulent or toxic

¹ American Journal of Insanity, 1916, lxxii, 643-648.

² Journal of American Medical Association, 1916, lxy, 1545.

variety, as in the infectious types. The researches of Goldmann and others have demonstrated that the choroid plexus acts as a limiting membrane, preventing the passage of substances directly from the blood to the cerebrospinal fluid. Hence, the idea of promptly reaching the tissues of the central nervous system through the general circulation was long ago abandoned, and for a number of years remedial substances have been introduced into the spinal canal through lumbar puncture. This method has proved very satisfactory in certain varieties, especially those due to a meningococcic or influenzal infection, in those cases in which the openings between the ventricles and the general subarachnoid space are quite patent, providing the serum be injected during the early stages of the disease.

Not infrequently, however, as has been brought out by the recent observations of Chiray¹ and Neveu-Lemaire, Debeyre and Rouvière,² the ventricles become distended with sero-pus, giving rise to a condition which they term "*pyocephalus*," caused by a suppurative ependymitis, the retention of purulent fluid with the resulting distention of the ventricular walls and the blocking off of these cavities from the general subarachnoid space. In such cases one could scarcely hope that remedial agents introduced into the spinal canal should reach the focus of infection within the ventricles. It is only through intraventricular injection of serum that these foci are to be reached, and Chiray believes the only logical treatment of these cases is by intraventricular injections.

I recently was asked to see an infant with an influenzal meningitis which had been treated by lumbar puncture and intraspinal injections of the anti-influenzal serum. Forty-eight hours before I saw the case, lumbar puncture failed to recover, as heretofore, purulent cerebrospinal fluid, but only a few drops which were quite clear. The natural deduction was obstruction of the lateral ventricle; and the remedy, puncture of the ventricles through the corpus callosum and the direct intraventricular injection of the serum. Upon introducing the cannula, fifty-odd c.c. of fluid escaped from the ventricles and the signs of excessive intracranial tension subsided. Ten c.c. of the serum were introduced and the wound closed. Unfortunately, the operation had been postponed until the patient was *in extremis*, and the child died. There is no doubt at all in my mind that what is called "*pyocephalus*" is a frequent cause of death in meningitis, and the direct method of relieving pressure and introducing the serum by ventricular puncture should be practised more frequently.

If practised sufficiently early, it should bring about a subsidence of the symptoms of increased intracranial pressure and effect a cure, even in the most desperate cases. Symptoms of *pyocephalus* usually occur, as in the case of Neveu-Lemaire, during the convalescent period when the patient

¹ La Presse Médicale, 1915, xxiii, 481-484.

² Ibid., 1916, xxiv, 415-417.

seems apparently on the road to recovery; they have the appearance at first of a return of the meningitic symptoms, but resumption of the intraspinal injections is of no avail. The patient becomes very much depressed, with a tendency toward somnolence or partial coma; the pulse becomes accelerated, the temperature may be normal, but is usually of the intermittent febrile type, characteristic of ventricular lesions, and there is frequently vomiting. The trophic disturbances, wasting of the muscles and dryness of the skin, are most pronounced. There is trembling and weakness; the tendon reflexes are diminished or abolished, and there is loss of control of the bladder and rectum. These symptoms gradually become more pronounced until the patient succumbs in from two to five months. The entire syndrome, however, may be abolished if the symptoms be recognized early and the serum introduced directly into the ventricles. The fluid obtained from lumbar puncture in these cases is usually clear and indicative of recovery, while that from the ventricles will be very turbid. In an epidemic of 40 cases of meningococcic meningitis, Chiray reports 3 cases which developed these chronic symptoms and finally terminated fatally. The autopsies showed that infection in the ventricles was still in an acute or subacute state, while there was almost complete retrogression of the pericerebral inflammation. As the result of these observations, he urges most strongly that intraventricular injections be administered as soon as the symptoms of pyocephalus appear.

Ventricular puncture itself is not a new or difficult procedure. It has been advocated and performed many times by Cushing, myself and others in this country, and by Krause, Horsley and many others abroad. Its application to these chronic types of infectious meningitides is also not new, but it has never received the proper attention. It was advocated as far back as 1908 by Cushing and Slaven, and again by Netter and Debré in their monograph on *La méningite cérébrospinale*, and by Triboulet and by Merle. Successful cases have been reported by Fischer, by Lewy and Bouché, by Cushing and by Triboulet. Netter¹ has applied intraventricular injections of antimeningococcic serum in 12 cases, and in 2 others serum was injected between the upper vertebrae. None of the infants recovered, but most of them were in the advanced stages. In the case reported by Debeyre and Rouvière,² complete recovery followed the withdrawal of 35 c.c. of fluid and the introduction of 15 c.c. of antimeningococcic serum. They make a trephine opening over the frontal portion of the right lateral ventricle 3 cm. in front of the bregma and 2 cm. to the outer side of the median frontal plane. This point is chosen in order to avoid the superior longitudinal sinus and the anterior branch of the middle meningeal artery. The needle, which should be 8 cm. long and 7 to 8 mm. in diameter, is held in a slanting

¹ Bull. de l'Acad. de méd., 1916, lxxv, No. 12.

² Loc. cit.

direction, downward, backward, and inward, in order to be sure of penetrating the frontal prolongation of the lateral ventricle, and introduced 3 to 4 cm., according to the age of the child and the degree of dilatation. While the recorded cases of intraventricular puncture are still too few to give an accurate estimate as to its value, it is certainly the most logical method we now have of treating these chronic cases of so-called pyocephalus, and should at least be given a fair trial.

In a paper on the surgical treatment of bacterial infections of the meninges, Naffziger¹ again emphasizes the need of ascertaining the cause of the increased intracranial pressure. Whether the invasion of the bacteria has caused a hypersecretion of fluid by the choroid plexus, or whether it has interfered with normal absorption, either by obstruction to its outflow from the ventricles or by blocking the normal outlets of the cerebrospinal fluid, be they Pacchionian bodies, arachnoidal villi or what not, with their infectious products, is a most important question from the stand-point of treatment. If the latter condition exist, the establishment of new drainage paths from the ventricles to the subarachnoid space could be of little avail, while if the pressure be due to a damming back of the fluid in the ventricles, a callosal puncture might give the needed relief of tension. Naffziger has performed Haynes' operation of drainage of the cisterna magna in 3 cases of infectious meningitis, but all 3 cases terminated fatally, and this is in accord with the results of other observers.

In regard to the *infection of the meninges and brain complicating gunshot wounds*, the prognosis depends not so much upon the extent of the injury as upon the type of the consequent infection. It has been Whitaker's² experience that streptococcic infection is followed by a mortality of over 90 per cent., while patients in whom infection is due to *Staphylococcus aureus* or *albus* "put up an amazing fight; and their defeat, if they be defeated, is practically always due to the infection of their ventricles and a subsequent spreading basal meningitis." Autopsies in these cases showed that firm adhesions between the pia arachnoid, dura and skull were present, thus shutting off the infected portion of the brain from the surrounding areas. On the other hand, in the streptococcic cases there were either no adhesions or very feeble ones.

There were certain clinical differences between these two types of infection. In the staphylococcic cases the patient may be comatose, maniacal, or paralytic, and he may suffer from fits and cerebral vomiting; but his hernia is always covered with a firm, glossy surface membrane which remains unruptured until it begins to shrink. In the streptococcic cases the hernia grows very rapidly and has none of the above mentioned local signs; the patient, moreover, is usually comatose or somnolent. Sir Victor Horsley and Whitaker have conducted a series of experiments

¹ California State Journal of Medicine, 1916, xiv, 3220-3224.

² British Journal of Surgery, 1916, iii, 708.

on rabbits in connection with these cases of head injuries. The rabbits were injected with cultures of the different organisms. Streptococcic inoculation was invariably fatal in its effects, most of the animals succumbing in two or three days. Staphylococcus aureus was variable in its effects, some of the rabbits dying in two or three days and some living longer.

Trigeminal Neuralgia. In reviewing his experience with trigeminal neuralgia, Beckman¹ concludes: "At the present time, evulsing the posterior nerve root or removing the ganglion entirely is the only operation ensuring permanent relief, and the mortality is no higher than that of many serious operations performed daily by surgeons throughout the country. [It is very much less. I have had no fatalities in the last fifty cases.—REVIEWER.] Therefore, since patients with trifacial neuralgia do not recover spontaneously and the results of peripheral operations and injections are so temporary, this should be the operation of choice for a person in reasonably good physical condition."

Out of 177 cases of trigeminal neuralgia treated at the Mayo Clinic, 18 were subjected to a radical operation upon the Gasserian ganglion or its sensory root; in 11 cases a gasserectomy was performed according to the Hartley-Krause technic, in 1 according to Abbe's method, and in 6 cases the posterior root was resected according to the reviewer's technic. Thirteen patients were "completely relieved of their pain, or the recurrences have been so slight that they considered their condition satisfactory." The recurrence which followed in 3 cases, Beckman attributes to the failure to remove either the entire ganglion or all the fibers of the sensory root during the early performance of this operation, and he emphasizes the necessity of going well back of the ganglion in order to expose the posterior root in its entirety.

There were two deaths following gasserectomy, one in a woman, aged sixty-one years, which was due to a hemorrhage on the twenty-first day after the operation; in another case, a woman, aged forty years, died within twelve hours of the operation, but no autopsy was obtained and the cause could not be ascertained. Some of these patients were operated upon several years ago, and Beckman states that probably "the same number of patients operated on today would give approximately 100 per cent. permanent relief from pain." It is a grave operation to be sure, but the technic, both for resecting the sensory root and removing the ganglion, has become so perfected that the operation is practically without risk in the hands of those specially skilled in brain surgery, and it is only to those that such a delicate procedure should be entrusted.

Muskens² has introduced a slightly different operation; in place of removing the ganglion, resecting its sensory root, or destroying its cells through alcohol, he aims to bring about degeneration of the ganglionic

¹ *Annals of Surgery*, 1916, lxiv, 242-247.

² *Nederlandsch Tijdschrift voor Geneeskunde*, 1916, l, No. 26.

cells by crushing with clamps. The axis-cylinders of the second and third branches are crushed to the thinness of paper, so that regeneration is out of the question. He claims this procedure is followed by complete atrophy of the cells of the ganglion. Muskens has applied this method in 5 cases; in 1 the operation was performed twelve years ago for neuralgia of twenty-five years' duration, and there has been no recurrence.

A study of the anatomical difficulties encountered in injections of the Gasserian ganglion according to Härtel's technic has been made by Dorrance¹ during the past year. In the course of his work, Dorrance injected the ganglion with methylene blue on both sides of 210 cadavers. Instead of using the second molar as a guide, according to Härtel's stipulations, he measured 2 cm. from the angle of the mouth and inserted the needle 0.5 cm. above that point; in all other respects he followed the Härtel technic. He failed to reach the ganglion in only one instance, and in no case was the middle meningeal artery cut. The average depth required for penetrating the ganglion in the 420 injections was 6.4 cm., and careful examination of the ganglion after injection showed that the needle passed under the ganglion into the dura in many instances, so that the cells were only partially infiltrated. In other cases the needle went to a point midway between the ganglion and the dura, so that the methylene blue failed to stain the cells. Naturally, the ganglion is shrunken on the cadaver, and these results would not be so frequent in the living subject. Dorrance believes that the injection of the ganglion is a comparatively simple procedure (this statement needs qualification), and he strongly advocates it after peripheral injections have failed to give relief. (See reviewer's commentary, page 43.)

Pollock and Potter² have attempted to obviate some of the difficulties arising in injections of the ganglion by using the fluoroscope to aid in orientation. From their experience, both on the cadaver and the living subject, they have found Härtel's method the most satisfactory. The needle is introduced, according to Härtel's directions, through the cheek opposite the alveolar process of the second upper molar tooth, and between the anterior ramus of the lower maxilla and the tuberosity of the upper maxilla. It is advanced between the buccinator and the masseter into the zygomatic fossa, and then backward and slightly inward until it reaches the broad undersurface of the great wing of the sphenoid. When the head is viewed laterally through the fluoroscope, Pollock and Potter found that the shadow thrown by the anterior border of the petrous portion of the temporal bone forms a line which is the direct projection of the shadow cast by a needle directed between the second and third molars of the upper jaw. If a needle be introduced at this point and directed, as Härtel directs, so that it points to the pupil of the eye of the same side, it should come approximately near the foramen

¹ Pennsylvania Medical Journal, 1916, xix, 814-826.

² Journal American Medical Association, 1916, lxvii, 1357-1359.

ovale. As a further guide, the authors suggest that the needle be directed so that a projection of its shadow follows the shadow of the anterior border of the petrous portion of the temporal bone, or 1 or 2 mm. below it. The anteroposterior and superior planes of the foramen ovale are thus located. To determine the superior inferior plane, an opaque Eustachian bougie may be employed. They have applied this method only once on the living subject. In this case the second and third divisions of the ganglion were easily reached and injected, and there was immediate relief of pain, and analgesia.

While procedures upon the peripheral branches may be indicated in the milder cases, or in cases in which the radical operation is contra-indicated for one reason or another, nevertheless they are almost invariably followed by recurrence. Of the 177 cases treated in the Mayo Clinic¹, avulsion or excision of a peripheral nerve was performed in 19 cases, 3 supra-orbital, 9 infra-orbital, 5 inferior dental, and 1 lingual. In 10 cases which they were able to trace, the longest period of relief was two years, in 5 cases there had been relief for one year or more, the average being 8.4 months. In 146 cases in which peripheral injections of alcohol had been given, 120 were traced. In 1 case there had been relief for five and a half years, in another for three years, and in still another for three and a half years. But, on the other hand, only 30 had been relieved for more than one year, the average period of relief being 9.4 months. In 77 cases the relief was only for six months or less. Thus, it would seem that peripheral operations and peripheral injections are of value only as temporary procedures and should be looked upon only as such.

Alcoholic injection into peripheral branches, into the second and third divisions, or into the ganglion itself, requires much training and experience. Some of the attempts made by physicians without experience upon patients that have been afterward referred to me for treatment are, to say the least, grotesque. Stiffness of the jaws, corneal ulceration, and facial palsy are some of the unfortunate results from the attempts of the inexperienced in giving alcohol injections. The most serious aspect of the alcoholic injection is the incidence of corneal complications. Härtel himself reports 6 cases of keratitis in twenty-four injections on 25 patients. This in itself is a serious indictment. As a precaution against keratitis, I believe it is important to limit the amount injected to 1.5 c.c., and I am still in doubt as to whether, in the face of the frequency of keratitis following injection, one is justified in employing this method as a substitution for the radical operation, except when the latter is distinctly contra-indicated. This is my present attitude. I would suggest, for the benefit of those who find difficulty in reaching the second division (and it is anatomically impossible in 20 per cent. of cases), an alternate method

¹ Beckman, *loc. cit.*

of producing the same effect by injecting the ganglion through the third division. This method I have used a number of times with great satisfaction. As to the lasting effects of alcoholic injections, Beckman's experience about tallies with preëxisting figures. There will be an occasional case with relief for three or more years, but the average period of relief is about nine months, and, what is of greater significance, the period becomes shorter with successive injections. Furthermore, I am convinced that the frequent injection of alcohol into the second and third divisions renders the operation upon the ganglion more difficult. At each injection, if successful, more or less alcohol finds its way, if not into the ganglion, at least beneath the ganglion and its dural envelope, so that the separation of the dural sheath from the ganglion becomes the most difficult feature of the operation.

Fractures of the Skull. As a result of his analysis of 1000 cases of fractures of the skull treated at the Cook County Hospital, and of 74 examined at autopsy, Besley¹ has come to the conclusion that the majority of fractures of the base are due to direct in-bending force applied through the articulation of the condyles and atlas rather than to a bursting force. He found that fragments of the base occupied the same position and were of the same extent, regardless of the location of the vault injury. Every case of fracture of the occipital or posterior fossa was a direct continuation of a fracture of the vault. Occasionally, when the head is caught between two fixed points, the bursting force is the prime factor, but in the majority of instances basal fractures are due to an in-bending force or are a direct continuation of a fracture of the vault. In 74 autopsy cases, there was in 54 instances an association of fracture of the base and vault, while in 1000 cases this association was noted by the clinician in only 33 per cent.

The röntgenogram is the surest method of diagnosing fractures of the skull, but it is by no means infallible; all the signs of increased intracranial pressure are usually present, such as unconsciousness, vomiting, choked disk, slow pulse, an embarrassed respiration, the severity of the signs depending upon the extent of the hemorrhage and edema; the focal symptoms depend, of course, upon the site of the injury. As shown in the analysis of 1000 cases at the Cook County Hospital, the respiration is always higher in the fatal cases; vomiting was a prominent symptom in 361 cases. The patellar reflexes were increased in 67 and absent in 50, with no change in the others. Babinski's reflex was observed in 55, and Kernig's sign in 8 cases; general convulsions were noted in 32 cases; clonic convulsions of the arm occurred in 6 cases; of the leg in 2 cases, and of the face in 7. Rigidity of the legs was observed 29 times, and of the neck 29 times. There was complete paralysis of the muscles of the face in 47 cases, of the muscles of the legs in 55, and of the muscles of the

¹ Journal of American Medical Association, lxvi, 345-350.

arms in 58. There was escape of blood and cerebrospinal fluid from the ears in 316 instances; bleeding from the right ear in 131; from the left ear in 146, and not stated in 18. Free bleeding from the orbital cavity was present in 10 cases, and cerebrospinal fluid unmingled with blood escaped from the ears in 21 cases.

Opinions vary as to the advisability of performing lumbar puncture for diagnostic purposes. Barnes and Slocum,¹ who have recently analyzed 27 cases of fracture of the skull treated at the German Hospital, Philadelphia, since January, 1910, advocate lumbar puncture both for diagnostic and therapeutic purposes in every case of severe head injury. The puncture should be repeated daily until recovery ensues. Besley² believes that it is often a dangerous procedure, since the medulla and pons may be forced into the foramen magnum, leading to a fatal outcome. He therefore advocates it only in those cases in which a diagnosis can be reached in no other way. I have used lumbar punctures repeatedly in cases of cerebral trauma, but chiefly for two reasons, for diagnosis and for the relief of headache. When the intracranial pressure is such as to suggest the propriety of repeated lumbar puncture, better results will be obtained by a subtemporal decompression. In all doubtful cases of cranial trauma the withdrawal of blood-stained fluid, of importance from the medicolegal view-point, in proving beyond a question of doubt the existence of an injury to the cranial contents that cannot be said to be trivial, at once establishes evidence that cannot be controverted. As for lumbar puncture in the relief of headache, we have a most effective therapeutic measure which should always be availed of when the headache is intense and unbearable.

The indications for operation in fracture of the skull include depressed fragments in the vault and grave cerebral contusion in fractures of the base. With Elsberg,³ I believe that operation is called for only when the symptoms indicate an advancing lesion; when stupor is becoming deeper; when there are increasing changes in the fundi; when weakness passes into paralysis and twitching into convulsions. My views upon this subject have been fully discussed in previous numbers of *PROGRESSIVE MEDICINE*.

Elsberg divides patients with fracture of the skull into the following five groups:

1. Patients with evidence of fracture of the vertex with few, or no, brain symptoms, no loss of consciousness, no twitchings, paralysis, or convulsions. These patients need not be operated upon, but they must be carefully watched for the appearance of new symptoms. At any time during a number of days after the head injury they may develop signs of cerebral compression due to slow venous bleeding or to edema of the

¹ New York Medical Journal, 1916, ciii, 309.

² Loc. cit.

³ Surg., Gyn. and Obstet., 1916, xxiii, 153.

brain. The pulse and respirations must be taken at short intervals and the eye-grounds carefully examined every few hours. If the symptoms show a tendency to progress and are well localized to one part of the brain, the surgeon may be in doubt whether there is increasing extradural or intradural hemorrhage. An exploratory puncture of the skull may then have to be done, and it can often be accomplished under local anesthesia. A small drill hole is made through the soft tissues of the scalp and the bone and a blunt-pointed aspirating needle is passed through the drill hole until the dura is reached. If aspiration fails to reveal blood, the needle is pushed through the dura and aspiration is again done. By this means we are able to determine, with certainty, whether there is any considerable collection of blood inside or outside the dural sac. If the symptoms become more marked, an exploration or a subtemporal decompression may become necessary.

2. Patients with partial or complete loss of consciousness, weakness of one side of the face, marked weakness or paralysis of the upper or lower limb of the same side or of both limbs, exaggerated tendon reflexes, with ankle-clonus, slow pulse, and respiration. These patients have either a marked depression of bone or a large extradural or intradural collection of blood, and must usually be operated upon. The operation that must be done is either removal of depressed fragments of bone, removal of extradural extravasation of blood with ligation of a bleeding middle meningeal artery, or incision of the dura, with removal of a subdural collection of blood and treatment of lacerated brain tissue. If none of the conditions just mentioned be present, a subtemporal decompressive operation should be done. (For purposes of exploration in cases of suspected intracranial hemorrhage, the technic which the reviewer has adopted is as follows: An incision is made from a point 2 cm. in front of the midpoint between the glabella andinion and extended downward toward the base of the zygoma to terminate within the hair line, the edges of the wound retracted and rolled back with the series of hemostats applied to bleeding-points, one to three holes are drilled with a Hudson drill at equidistant points, through which the presence of an extradural hemorrhage may be seen, or, by inspection, the presence of a subdural clot detected. Upon discovery of a hemorrhage at one of these exploratory borings, the opening may be enlarged sufficiently to deal with the condition found. This method covers the field of possible extradural hemorrhage and of intradural bleeding in the neighborhood of the Rolandic fissure. It accomplishes the purpose expeditiously with the least degree of mutilation of the skull, and should take the place of an osteoplastic resection.—REVIEWER.)

3. Patients with few symptoms but with hemorrhage from ear or nose, etc.

4. Patients in whom few symptoms are present at first but who develop, after a few days, signs of increased intracranial pressure, papillo-

edema, drowsiness, respiratory disturbances and slow pulse. The symptoms are due either to slow venous hemorrhage or to edema of contused brain tissue. If the signs point to a localization of the compression of the brain, an exploratory trephining must be done over that region, otherwise a subtemporal decompression is indicated.

5. Patients with the signs of fracture of the base. As soon as any symptoms of increased intracranial pressure appear, a subtemporal decompression must be performed. (Again, I must protest against the routine practice of decompression in all cases of cerebral contusion that may be attended with signs of pressure, and reiterate my preference for an intelligent classification of those cases wherewith to formulate the indications for operation. The reader is referred to a discussion of the subject in *PROGRESSIVE MEDICINE* for March, 1915 and 1916.—REVIEWER.)

Sharpe,¹ in his recent paper on the treatment of brain injuries states that the expectant palliative treatment alone is all that is necessary in most cases of fracture of the skull; a certain number, however, somewhat less than 50 per cent., do require operative relief of the increased intracranial pressure. He believes that the post-traumatic conditions are often caused by the effect of this prolonged increase of the intracranial pressure and that a large percentage of these conditions may be improved by relieving the intracranial tension even months after the injury. The operation of choice, in both the selected acute and the chronic cases of brain injury, is the subtemporal decompression. With this conservative view of the indications for decompression the reviewer heartily agrees.

As to the *prognosis* in cases of fracture of the skull, Besley² found, in the series of 1000 consecutive cases treated at the Cook County Hospital, that the mortality was 53 per cent. Of 227 cases of cranial fracture treated by Sharpe,³ 79 were operated upon, with 14 deaths; while in 160 cases not operated upon there were 49 deaths, the total mortality for the 227 cases being 27.8 per cent. In 27 cases analyzed by Barnes and Slocum, and referred to above, there were 14 recoveries and 13 deaths. In Elsberg's series of 60 cases of fracture of the skull, 24, or 40 per cent., recovered without operation; of 22 patients operated upon, 17 recovered and 5 died, the deaths being due to extensive and hopeless laceration of the brain. Fourteen, or 23 per cent., were in a moribund condition when admitted to the hospital, and nothing could be done to improve their condition.

Wounds of the Skull and Brain. A great mass of literature on head injuries has appeared from the European nations in the War Zone during the past year. Individual surgeons have reported their experiences in large series of head injuries, in some instances as many as 300 cases, but the time intervening between the injury and the operation is so variable in the various series, depending largely upon whether the report be from

¹ *Journal American Medical Association*, 1916, lxvi, 1536-1540.

² *Loc. cit.*

³ *Loc. cit.*

a clearing station at the front, a base hospital or general hospital, that it is difficult to draw definite conclusions. In many of these reports the immediate outcome alone is considered, and some time must elapse before the results of the various operations can be judged from the stand-point of the ultimate result with respect to mental states and functional capacities.

By far the most disputed, and possibly the most important, point in the management of cerebral injuries at the seat of war is as to the proper time for operation and as to the operative indications. The consensus of opinion now seems to be that practically all cases in which the skull has been fractured or penetrated call for surgical intervention, although some surgeons are more discriminating, and a few are still more conservative and operate only in cases with definite signs of increasing intracranial damage. At this writing it appears that the results of the more radical as compared with the more conservative practice have been so encouraging that surgeons are increasing rather than decreasing the indications. The time elapsing between the injury and the arrival of the patient at the hospital is an important factor in determining the propriety of operating. In an excellent review of the subject, Whitaker¹ states that the "radical principle should be followed when cases arrive within three days of injury. During this period it is possible to prevent or mitigate the effects of sepsis, and therefore it would seem to be reasonable in every case in which the skull is certainly, or probably, fractured, to explore, trephine, and then act according to the conditions discovered. Similarly, when cases arrive at a late period, fourteen days or more after injury, the second or conservative principle is clearly indicated, although even in such circumstances certain cases should still be submitted to operation."

The greatest nicety of judgment, however, is required for the intermediate cases, arriving seven to ten days after the injury. In such cases, according to Whitaker, the following types demand immediate operation: Active septic processes in a badly drained wound; evidence of cerebral irritation, as fits, restlessness, or delirium; evidence of cerebral compression, notably severe headache, coma and slow pulse.

In another group, consisting largely of those cases with active and acute infection of the scalp, associated with evidences of cerebral compression or irritation, operation is demanded, but should, if possible, be deferred until the superficial wound has been cleaned and drained.

Operation is indicated, but may be postponed in clean cases in which the *x*-rays demonstrate depressed fragments of bone or foreign bodies which can be definitely localized. No operation is required in the following cases: (1) Those with no evidence of sepsis, but with a foreign

¹ British Journal of Surgery, 1916, iii, 708.

body not causing progressive symptoms; (2) Cases already submitted to a primary operation in which both free drainage and efficient decompression have been provided. There are three groups of cases in which Whitaker advises a waiting policy before deciding for or against operation, namely: (1) Those patients whose general and local conditions are apparently hopeless; (2) cases already operated upon in which the wound is healed but the general condition remains unsatisfactory; (3) cases with healed wounds and no local evidence of sepsis, but with a foreign body in a position which can only be reached with difficulty, and with symptoms of grave cerebral injury but not of cerebral compression.

Cushing,¹ as the result of his experience at the American Ambulance in Paris, has come to the conclusion "that almost all cranial wounds produced by projectiles, even though they appear trivial, require surgical investigation with the possible exception (1) of certain of the tangential longitudinal sinus injuries, which have a high degree of spontaneous recoverability, and which, when investigated, present unusual surgical risks; and (2) of certain of the fractures of the base due to perforating wounds, owing to their inaccessibility." With the exception of cases with extensive hemorrhage, operation should be deferred until the patient has been transported to a suitable base hospital.

As the result of his experience in a clearing station, Don² believes all scalp wounds should be completely excised as early as possible, provided the patient's condition will permit a general anesthetic, and when the cranium has been injured or there are cerebral symptoms suggesting intracranial pressure, the trephine should be used and the dura opened if necessary. Operative exploration is advised by Frey and Selye³ in all cases, as it is quite impossible to determine the extent of the lesion from the external appearance of the wound. If the bone be found intact, the operation should be discontinued, but, if the bone be injured, the skull should be opened, further intervention depending upon the conditions found. The French surgeons seem to be almost universally in favor of immediate intervention in practically all cases. According to Rendu⁴ all wounds of the scalp should be carefully explored; if the external table of the skull be intact, the cranium should be opened in cases with functional disturbances; otherwise a waiting policy is best. One should trephine in all cases with involvement of the internal table and determine the conditions beneath the dura. The opinions of Latarjet, Sencert, Cotte, and Tisserrand, as expressed in the same number of *Lyon Chirurgical*, are very similar.

Granted that operation is indicated in all cases of penetrating wounds, with a very few exceptions, what is the proper method of procedure?

¹ The Military Surgeon, 1916, xxxix, 22-30.

² Lancet, 1916, i, 1034.

³ Wien. klin. Wchnschr., 1915, xxviii, 722.

⁴ Lyon Chir., 1916, xiii, 387.

Here again there is considerable difference of opinion as to the method and extensiveness of the investigation. The first essential is free exposure of the injured area of the skull and brain. This is usually accomplished by a flap in the simple cases and by irregular incisions, if the wound be more complicated. Whitaker¹ advises continuous irrigation of the entire wound with 1 to 40 carbolic acid solution after the operation is begun. For controlling hemorrhage he does not employ ligatures or sutures, but advises grasping the flap at its base with an intestinal clamp and seizing the vessels on its concave side with pressure forceps, the latter being left *in situ* until twenty-four hours after the operation. Muscle grafts or gauze should be used to control bleeding from dura, pia, and brain. If it be necessary to enter the cranium with the trephine, Whitaker's practice is to do this, immediately adjacent to, rather than directly over, the depressed fracture. The trephine hole, or the original wound, should be enlarged until half an inch of normal tissue is exposed around the wound, and for this purpose Whitaker uses Hoffmann's forceps, with which pieces of bone may be grasped and bitten off without jarring the brain.

After the skull has been opened, the irrigation fluid is changed to hydrogen peroxide and the investigation of the brain commenced. During this process great care should be taken not to interfere in any way with the original injury to the dura, for arachnoidal adhesions are very easily formed and are the starting-point of meningitis. Blood-clots should be carefully washed away. After this, the irrigating fluid is changed once more to 1 to 40 carbolic acid solution. An unperforated rubber sheet or dam is put over the exposed dura and brain and a perforated rubber sheet over the wound area after the flaps are closed. Whether drains should be used is still a moot point. Don² states that drains into the brain tissue are useless in early wounds, and are probably detrimental to brain tissue.

It is impossible to tell from the external wound how extensive an operation will be required. Many wounds which appear very trivial on the outside should have thorough neurological and röntgenological studies, and may call for elaborate operations. If some cases be abandoned after the removal of a few fragments of bone, infection and hernia may follow, with dire results.

However, the factor of time in operations upon patients desperately ill is important, and Whitaker makes it a rule that the patient be off the operating table *in twenty minutes*. The importance of liberal decompression is universally accepted, not only as a factor in saving life but in hastening convalescence and increasing the chances of ultimate complete recovery. Whitaker has often been surprised at the swift and uneventful recovery of cases in which the injury appeared hopeless and in which a

¹ Loc. cit.

² Loc. cit.

really enormous decompression was done *faute de mieux* because the fracture radiated in all directions and great sheets of bone were found loose in the wounds. Similar experiences by other surgeons have led to large cranial openings; in fact, Leriche¹ attributes the cerebral herniæ, which so often appear in cases of cerebral injury, to an insufficient opening in the skull. If the herniæ become large, Leriche advises a second larger decompression which, in his experience, has often resulted in complete recovery. Prolonged search for fragments of bone and foreign bodies is advocated by some and tabooed by others; according to Whitaker, it is not only unnecessary but dangerous, (1) because of the unnecessary prolongation of the operation, and (2) because of the possibility of wounding the ventricle. The brain wound should, in all cases, be thoroughly explored, and all obvious fragments of bone and foreign bodies removed, but continuous search for hidden bits is decidedly detrimental. The brain, moreover, is far more resistant to both sepsis and irritation than has been heretofore supposed. Prolongation of the operation for patients in a critical condition may often mean a loss of all chances of recovery. As little probing as possible should be done. Don² advises no probing of any kind in the absence of an x-ray showing a missile. Perthes³ has advised a means of using a narrow, flexible piece of metal over the finger, instead of a probe, for finding splinters and foreign bodies.

The statistics on the results of operations for these injuries of the head during the past year are quite encouraging, though, of course, it must be borne in mind that most of these are immediate, not end, results. Barring cases in which the patient is practically moribund upon arrival at the hospital, the mortality rate is gradually decreasing. This is due to the added skill in removing foreign bodies, in coping with infection, and in dealing with the various problems of increased intracranial pressure, and may be attributed in part to the adoption of the steel casques, which minimize the trauma inflicted by the small shell and shrapnel bullets; but so long as trench warfare continues, head injuries will continue to be numerous and serious, since the casque affords little protection against the large machine guns.

As a result of 36 operations for brain injuries, Frey and Selye⁴ have reported a mortality rate of only 8 per cent., and state that the paralysis and other functional disturbances disappeared rapidly. Don's⁵ mortality rate, in cases reaching a clearing station fifteen to twenty miles behind the firing line, was about one in ten, when every case not moribund was operated upon for urgent symptoms only, the other cases being passed on to the base hospital for localization and removal of foreign bodies.

¹ Lyon Chir., 1916, xiii, 448.

³ München. med. Wochenschr., 1915, lxii, 1706.

⁵ Loc. cit.

² Loc. cit.

⁴ Loc. cit.

Whitaker's¹ results in 104 operations in coöperation with the late Sir Victor Horsley are tabulated as follows:

Gunshot wounds of cranium.	Number of cases.	Number of deaths.	Mortality per cent.
Total cases	118		
Total cases operated upon	104		
Cases of extradural injury	16		
Cases of intradural injury	88	19	21.5
Not operated upon before arrival	64	6	9.3
Operated upon before arrival	24	13	52.5
Total cases of streptococcal infection	16	14	87.5
Operated upon before arrival	14	13	92.9
Not operated upon before arrival	2	1	50.0

Between August 1, 1914, and June 15, 1915, Sencert² had under his care 250 cases of head injuries 163 of which were operated upon. Of the 163 operated upon, 104 were discharged from the hospital as cured or on the road to recovery. One year after the last operation he attempted to trace these cases, and of 71 replies received, 24 were reported dead and 47 living. Of the 47 surviving there were on the invalid list 25; under treatment in the hospital, 5; returned to the station, 10; returned to the front, 5; transferred to the auxiliary service, 2; percentage of recoveries one year after operation, 75. In 35 cases reported by Cotte,³ the dura was intact in 25, and of this group there were 24 recoveries and 1 death. Of the 10 cases in which the dura was penetrated, 4 with extensive bone lesions and radiating fractures succumbed rapidly to meningo-encephalitis, and 1 died thirty-five days after the operation from meningitis; the remaining 5 were discharged as cured, but the end-results are not known.

Velter⁴ reports 9 deaths and 52 recoveries in a series of 61 cases, and in a series of 172 operations performed by Abadie⁵ there were 101 recoveries and 71 deaths. Of 70 penetrating wounds without lesion of the dura, there were 56 recoveries and 14 deaths, a mortality of 20 per cent. Of the 102 wounds with lesions of the dura, there were 45 recoveries and 57 deaths, a mortality of 56 per cent.

Intracranial Hemorrhage. After a careful study of *spontaneous intracerebral hemorrhage*, from both a clinical and pathological stand-point, Remsen⁶ has suggested a new surgical procedure which he terms ganglionic exploration or cerebrotomy. The larger of these hemorrhages arise from the posterior communicating or posterior cerebral, particularly those branches supplying the central ganglia, and their original seat is usually in the corpus striatum, the internal capsule, or the optic thalamus. These hemorrhages vary from the size of a pea to that of an entire

¹ Loc. cit.

³ Loc. cit.

⁵ Ibid., No. 53, p. 421.

⁶ Surgery, Gynecology and Obstetrics, xxi, 760-765; Annals of Surgery, 1916, lxiii, 513-518.

² Lyon Chir., 1916, xiii, 283.

⁴ Presse Méd., 1916, p. 59.

hemisphere, but their effects are not limited by the confining walls, for there is often serious hemorrhagic and serous infiltration into the neighboring tissues, which in time leads to secondary degeneration and the destruction of conduction paths and often of the ganglia themselves. There may also be continued evacuation of the hemorrhage, sometimes into the ventricle, sometimes toward the cortex, or into the crus cerebri. The increase in the general intracranial pressure and the reactive edema play not a small part in the symptom-complex and the fatal outcome of the majority of such cases.

The operation conceived by Remsen aims (1) to relieve the increased intracranial tension; (2) to relieve the local pressure upon the internal capsule; and (3) by evacuation and drainage of the hemorrhagic cavity to eliminate continued extravasation of blood from the striate body into the more important structures, to prevent the perihemorrhagic reactive edema and anemia, and to obviate the formation of the so-called apoplectic cyst. The technic of the procedure devised by Remsen is as follows: A vertical linear incision is made anterior to and well above the external auditory meatus. A similar incision is made through the temporal fascia, which is drawn back, exposing the fibers of the temporal muscle. The latter are then separated, and by means of a burr an opening is made in the temporal bone and enlarged with the rongeur forceps to the size of a silver dollar. A crucial incision is made in the exposed dura and the underlying cortex is carefully inspected, particularly along the fissure of Rolando. A brain spatula may be used in the search for signs of subcortical hemorrhage, and, if such be found, it should be evacuated through the exploratory tract and a gutta-percha drain carefully inserted into the hemorrhagic cavity. If the cortex appear normal or only edematous, a ganglionic exploration or exploratory cerebrotomy should be performed. For this purpose the surface of the island of Reil is located by carefully drawing apart the operculum borders just at, or anterior, to the points of intersection of the Sylvian fissure and the projected Rolandic fissure. A trocar is inserted at this point for a distance of from 1 to 3 cm., thus penetrating the gray and white matter of the island, the claustrum, the putamen, and the globus pallidus. If the clot be encountered, it should be evacuated and drained as the subcortical hemorrhage. If hemorrhage into the ventricle be feared, a ventricular puncture may be performed at this point. The dura is replaced but not sutured. Whether this procedure will prove effective as a means of saving life and preventing paralyses and the other grave sequelæ in these almost invariably fatal lesions is a question which can only be answered after it has been applied in a large number of cases.

In a paper on his further experiences with *intracranial hemorrhage in the newborn*, Green¹ emphasizes most strongly the necessity for early

¹ Boston Medical and Surgical Journal, 1916, clxxiv, 947-948.

diagnosis and operation during the first two or three days of life while the blood is still fluid and may easily be removed by drainage. At later periods complete removal is almost impossible, hence the danger of adhesions and other disturbances is much greater. The diagnosis should be confirmed by means of lumbar puncture or cranial puncture, or both. He groups these hemorrhages into the infratentorial and the supratentorial types. In the former, repeated lumbar puncture is of great palliative value, and may be curative as well. In the supratentorial type, Green recommends incision along the coronal suture at one or both lateral angles of the anterior fontanelle, followed by drainage with rubber tissue. More extensive procedures are not indicated, and are likely to prove fatal.

THE FACE.

Cauliflower Ear. This unusual condition is traumatic in origin, the ear being struck a glancing blow which folds it on itself and rolls it against the skull. There is usually a fracture of the cartilage at the site of one or more of the heavier eminences, commonly the antihelix. The perichondrium becomes stripped from the cartilage and raised by hemorrhage. This hemorrhage becomes mixed with a mucoid substance and a new tissue is organized varying from fibrocartilage to solid bone with contractions.

The patient complains of pain and tenderness, with, at times, loss of hearing due to occlusion of the external auditory meatus from swelling.

The above remarks are abstracted from a paper by Palmer.¹ He admits that he had tried all the various published methods of treatment without success until the following was devised:

"After preparing the skin surfaces of the ear, the meatus and immediate vicinity of the face and scalp, after any of the approved surgical methods except iodine, which causes intense itching, and plugging the external meatus with cotton, I make an incision under local anesthesia slightly below the prominent part of the swelling through the skin and perichondrium into the hemorrhagic cavity. All clots, newly formed cartilage, or bone should be removed with a small gouge or curet, the surface of both cartilage and perichondrium being scraped until smooth.

"The incision is now closed, except for a small opening which will just admit the end of a Eustachian catheter, connected through a waste bottle with a small Pychon pump.

"This rapidly removes the accumulated blood, and the suction approximates the loose layer of skin and perichondrium to the cartilage.

"The skin surface is now thoroughly dried, and a fresh plug of cotton is placed in the external auditory canal. A generous coating of sterile petrolatum is applied over both surfaces of the ear and the adjacent skin of the face and scalp.

¹ Journal of American Medical Association, 1916, lxvi, 422.

"Should there be any area in which the skin and perichondrium are not perfectly approximated, I make a small mold of dentist's modeling wax or sheet lead and apply pressure at that point.

"The mold, coated with petrolatum, is now placed about the ear, and half a tumblerful of plaster-of-Paris cream, prepared by an assistant, is poured into the mold, completely surrounding the ear.

"We now have the ear completely encased in the plaster, with the Eustachian catheter still inside the wound, and the pump working continuously. As the plaster hardens, a slight rotary motion of the catheter permits of its easy withdrawal through the cast, and establishes a permanent drain to the wound for the escape of any newly formed fluid.

"A small piece of gauze over the cast and an adhesive dressing to prevent all motion complete the the operation.

"The cast is removed by fragmentation ten days after the operation, when the ear will be found in exactly the shape you placed it at the time of the operation, and will require no further attention."

The article is illustrated by pictures showing the various steps of the procedure, but they are not clear enough for reproduction. For the benefit of those who have not seen this condition I am reproducing one of the illustrations (Fig. 1).



FIG. 1.—Complete occlusion of external meatus four weeks after injury, and result ten days after operation.

Excision of the Parotid Gland. The complete removal of the parotid gland is indicated in cases of malignant growth, and, as a rule, the operation is attended by a resection of the facial nerve, followed by an extensive deformity. Barbeck¹ reports the details of a case of endothelioma of the parotid gland in which the entire gland was removed without injury to the facial nerve. The dissection was begun from below. The posterior auricular nerve was dissected free and held to one side. The supramaxillary nerve was next picked up and dissected back through the gland with the buccal and intramaxillary branches, which were then dissected forward until they emerged from the anterior edge of the gland. The temporofacial division of the facial nerve was then dissected forward through the gland. Paralysis of the facial muscle

¹ California Journal of Medicine, 1916, xiv, 115.

was complete at first, but two months later there was evidence of returning motion, and eighteen weeks after operation motion was complete.

Salivary Calculi. There are few surgical conditions in which such immediate and considerable relief of annoying symptoms can be obtained as in the removal of stones in the salivary glands and ducts. Mathews¹ has observed and operated upon 6 cases. Three of the patients were about thirty years of age, the others between fifty and sixty. Haskin² reports 3 cases of salivary calculi. The first was removed from a male, aged forty-two years; who had had a submaxillary swelling for many months and a recent severe glossitis requiring incision for the evacuation of pus. The stone was removed by slitting up Wharton's duct. The second case occurred in a female, aged twenty-five years, who had suffered from a painful swelling under the right side of the tongue for about three years. The stone was removed by a simple incision made down upon it in the direction of the duct. The third case, a male, aged thirty-four years, had for years a swelling which increased at meal times and frequently became painful. Complete removal was advised, and exploration with a needle disclosed the calculus. The mass was removed through the mouth. Mathews describes three groups:

"(a) Patients, in whom, at intervals, especially at meals, there is pain and swelling under the jaw but no sign of inflammation. In these cases the stone is small and acts as a ball valve.

"(b) With, or without, a history of intermittent swelling in this region, there suddenly appears a painful swelling, with high fever, not unlike mumps. This may soon subside or go to the third condition.

"(c) A hard swelling forms under the jaw and a ligneous edema fixes the tissue of the floor of the mouth on the affected side. If pus forms, it is more likely to evacuate itself into the mouth than externally. Temperature subsides when the pus is evacuated, but a variable amount of induration may persist indefinitely. A sinus, discharging pus, may remain for months."

Mathews, as well as Haskin, removed the stones through the floor of the mouth. I have had but one experience with this condition and removed the entire gland by a submaxillary incision, because of the deep location of the stone and my inability to reach it by slitting up the duct.

SALIVARY CALCULI IN CHILDREN. It is interesting to note that this disease seems to be exceedingly rare in children. Neuhof³ has observed 3 cases. In the reported cases, and in 2 of the 3 observed by Neuhof, the symptoms were neither as severe as those generally seen in adult life nor of as long duration before the patients came under observation.

¹ *Annals of Surgery*, 1916, lxiii, 141.

² *Laryngoscope*, 1916, xxvi, 1031.

³ *American Journal of Diseases of Children*, 1916, xi, 232.

Of his 3 patients 2 were instances of solitary calculus in Wharton's duct, the third had multiple calculi in Stensen's duct.

Sialodochitis in Children. Neuhof states that two varieties of chronic sialodochitis have been described:

"One variety—the sialodochitis fibrinosa of Kussmaul—is characterized by sudden and recurrent attacks of duct obstruction caused by fibrin plugs. This very rare affection is exceedingly chronic, affects Stenson's ducts in most instances, and is generally bilateral. The earliest manifestations of some of these cases date from childhood. The second type is practically identical in the recurrence of attacks, in its chronicity, and the almost exclusive, generally bilateral, involvement of Stenson's ducts; it is chiefly differentiated by the absence of duct plugs."

He also reports an unusual case of inflammation of the parotid gland, and, from it, concludes: "There is a hitherto undescribed form of sialodochitis of Stenson's duct in children, secondary to inflammation of unknown origin, leading to an enlargement of the parotid gland that can be readily mistaken for sarcoma or mixed tumor. The gland is considerably increased in size, firm, nodular, and adherent; the orifice and buccal end of the duct are embedded in stenosing cicatricial tissue. There is a tendency to repeated recurrences of the parotid swelling after slitting the mouth of the duct, but cure promptly follows the excision of the diseased end of the duct."

Pulsating Exophthalmos. In 1908 several authors, and notably de Schweinitz and Holloway, published monographs upon this subject. In a recent paper, Rhodes¹ reports a case cured by ligation of the common carotid artery and collects from the literature 52 others reported since the appearance of the above-mentioned monograph. Of the series of 53 cases, 37 were found to be traumatic in origin, 9 occurred spontaneously, while in 7 the cause was not given. Exophthalmos, orbital pulsation, and bruit are the first symptoms to appear, and, of these, the most constant is the bruit. Atrophy of the optic nerve, paralysis of the abducens, and loss of pupillary reflex due to laceration of the carotid plexus of the sympathetic are also frequently present. Various minor symptoms, such as diplopia, hemorrhage or edema of the retina, tortuosity and dilatation of the retinal veins, are frequently encountered. Rhodes notes that the method of treatment employed in these 53 cases embraces practically all the known procedures that have been advanced, with the exception of electropuncture. He believes that while it is hard to draw accurate conclusions from a small number of cases, ligation of the common carotid artery is probably the safest method of treatment. In this series there were 15 cures, 3 improvements, and 4 failures. If failure follows this method, Rhodes believes that ligation of the superior ophthalmic vein, the so-called orbital operation of Sattler, should be performed.

¹ *Annals of Surgery*, 1916, lxiii, 389.

In his own case he ligated the common carotid with two silk ligatures. I feel that when the common carotid is ligated, a preliminary ligation with aluminum bands should be made to test the effects on the cerebral circulation. Forty-eight hours later a permanent ligation can be done.

It is interesting to note that Zentmayer¹ has also collected the cases of traumatic pulsating exophthalmos since the publication of Bedell's paper, and, on combining these cases with those analyzed by Bedell, he found that the common carotid artery was tied 32 times, with cure in 12, or 37.5 per cent., improvement in 12, or 37.5 per cent., and failure in 8, or 25 per cent.

The orbital operation (ligation of the ophthalmic vein) was done in 6 cases (including the case mentioned by de Schweinitz in discussion), with cure in 3, or 50 per cent., improvement in 1, or 16 per cent., and failure in 2 (one fatality), or 33 per cent.

Gelatin injections were used in 4 cases, with cure in 2, or 50 per cent., improvement in 1, or 25 per cent., and failure in 1, or 25 per cent.

It is to be particularly noted that in this combined series there are 32 cases of ligation of the common carotid without a fatality. Just how frequently late cerebral softening results is difficult to say, but if this complication can be averted, as is claimed, by slow ligation, it would seem that inasmuch as death may result from simple ligation of the ophthalmic vein, and that late serious hemorrhage into the orbit necessitating ligation of the carotid artery has occurred, and that finally, in traumatic pulsating exophthalmos the lesion is usually an aneurysm of the internal carotid in the cavernous sinus, the order of surgical procedure indicated is slow ligation of the common carotid, followed by ligation of the ophthalmic vein in those cases in which the primary operation fails to effect a cure.

Inasmuch as the results with gelatin injections have been favorable in the few cases in which they have been tried, there can be no objections to their employment if the patient is seen early.

In the discussion on this paper, Holloway brought out the interesting point that the common opinion that there was about 50 per cent. mortality from ligation of the carotid artery was untrue. From various sources he had compiled 182 cases, with a mortality of but 8.2 per cent. He also states that, as far as he can tell, only about 9 per cent. of the cases subjected to carotid ligation have been followed by cerebral complications. He does believe, however, in the newer methods of slow ligation.

THE JAWS.

Ankylosis of the Jaw. The work upon bones and joints done by Dr. John B. Murphy will remain a classic for all time. One of the operations

¹ Journal of American Medical Association, 1916, lxvii, 163.

which gave him most satisfaction was that for the relief of ankylosis of the jaw. He believed that this condition is often due to infection, in which case there are four routes of invasion: First, and most frequent, an extension of the suppuration from the middle ear; second, an osteitis or osteomyelitis of the mandible extending into the glenoid cavity; third, the metastasis from foci of infection within the mouth or elsewhere in the body, a part of a general metastatic arthritis. In addition to infection, ankylosis may result from a transmitted trauma from the tip of the chin to the articulation, giving a traumatic osseous fibrous arthritis.

Kreuscher¹ has reported 23 cases of ankylosis operated on by Murphy. The cases are completely described, the histories being given, and, in 18 instances, pictures of the patients before and after operation are shown.

In regard to after-treatment, Kreuscher states that a wooden wedge should be placed between the molars on the operated side and kept there day and night for at least two weeks, to prevent a possible compression necrosis of the interposing flap, and that mastication should be started at the end of two weeks. The wedge should be passed backward between the upper and lower molars, because if it is placed in front of the masseter muscles, pressure is brought to bear upon the fatty flap and much of it will be eventually destroyed.

They have learned that a hematoma very often forms about the field of operation, and if permitted to remain, may necrotize a portion of the flap or of the skin, not to speak of the culture medium for infection. Consequently, the wound should be watched carefully, and if there is the slightest evidence of a hematoma a small hypodermic needle should be inserted and the blood drawn off. This may be repeated on the second day and again on the third and fourth days, or even more often if necessary.

Kreuscher states that the results have been uniformly satisfactory. The one failure reported in the original article has since been reoperated on and has been given a perfect result. One other case showed evidence of a most complete failure, but was also reoperated with a perfect result.

In 1914 Blair² published an excellent paper on this subject which I did not abstract, owing to lack of space. He analyzed 212 cases from the literature and found that by far the most common single cause was trauma, this accounting for nearly 50 per cent. Next to injury came scarlatina, usually with suppuration in or about the wound, which accounted for about 20 per cent. of all cases. Otitis media, tooth infection, typhoid fever, etc., are other prominent etiological factors. Blair operates in a manner very similar to that of Murphy. His incision is similar to the one used by the reviewer in operations on the Gasserian

¹ Interstate Medical Journal, 1916, xxiii, 857.

² Surgery, Gynecology and Obstetrics, 1914, xix, 436.

ganglion, except that the long arms come farther down in front of the ear, but the remainder of the incision is in the hair line. It differs markedly from the incision of Murphy. The skin flap is turned downward and forward, a similar subcutaneous tissue flap containing the trunks of the temporal artery and vein uninjured is also turned downward, and the parotid gland and masseter muscle stripped downward with an elevator. The condyle, coronoid and upper part of the ramus are removed until there is a space of three-quarters of an inch between the ramus and the skull. The subcutaneous fatty flap is then sutured to the internal pterygoid muscle so that it rests between the cut portions of bone. The wound is drained with a rubber dam. Care is taken to see that the condition is not bilateral, in which case a double operation must be done. Blair keeps the mouth open for a week, which gives an immediate opening of three-quarters to one inch. By the use of a rubber bottle stopper, this opening is preserved or even increased in the next two months; later, the opening gradually increases until it may reach $1\frac{1}{2}$ inches.

Blair makes the very good suggestion that when there is excessive recession of the chin, the operation described above can be done on the ankylosed side, and on the other a simple subcutaneous resection of the ramus is done with a Gigli saw. Then the body of the jaw is drawn forcibly forward and held in this new position by wiring the lower to the upper teeth. These wires remain in place twelve weeks. Blair states that in the incision described the branch of the occipital frontalis muscle will be cut and the patient will be unable to wrinkle the forehead on that side. He found a number of cases of paralysis of the frontal nerve in the literature. He mentions the necessity for being ready to perform tracheotomy at any time during the operation. A complete list of the reported cases in tabloid form is given.

Tooth Germ Cysts of the Jaw. Much of our knowledge of these cysts has been gathered together in the writings of Bland Sutton, and, in this country, Bloodgood and Scudder have been prominent in describing them. A new description is offered by Wohl.¹ He believes that the conventional terms applied to these cysts are inadequate and misleading, since they neither designate the origin nor describe the clinical character of the tumor. He therefore divides the cystic tumors of the jaw into (1) inflammatory cysts; (2) tooth germ or chorioblastomatous cysts, divided into (a) unilocular cysts, commonly known as the dentigerous or follicular cysts; (b) multilocular cysts, conventionally designated as adamantine epithelioma, multilocular dentigerous cysts; (c) the solid tumor.

He states that these cysts are of infrequent occurrence, and in the present paper reports 6 cases which form the basis of his argument.

¹ *Annals of Surgery*, 1916, lxiv, 672.

The cysts are extremely slow in growth and practically symptomless. There is an absence of teeth over the area involved, and no fixation of the tumor to the bone of the jaw. The *x*-rays are of diagnostic value.

In discussing the etiology, Wohl takes issue with Bland Sutton and believes that they do not originate from the oral mucous membrane, but rather from the embryonal rests of the epithelial cord of the enamel organs. The article is illustrated by pictures, and a bibliography is appended.

Carcinoma of the Jaw. Bonney¹ reports the results of operations on 36 patients seen in the clinic of the late Dr. Roe. In 20 cases the mandible was affected, in 13 the maxilla. In 3 the disease was far-advanced, and both parts were involved. According to the patients' statements, the trouble began at periods varying from three months to two years prior to the time they came under observation. Thirteen were inoperable at the time of admission, and all died in the hospital at times varying from twenty-four hours to three or four months. Six patients refused operation, and, in 7 others, operation was not indicated; they had been treated surgically elsewhere and their condition contra-indicated operation. Eleven patients were operated on, with 2 immediate deaths, 2 others a short time afterward, and 1 eight months after operation. One patient died of recurrence five years and nine months later, and one other died from recurrence, the exact duration not being given. One patient is free from recurrence five years after operation; one is free from recurrence four years and seven months after operation; one patient, operated seven or eight months previously, is still in the hospital.

THE MOUTH.

Cancer of the Lip. Grant² goes over the usual ground in condemning caustic, *x*-rays, etc., and urges that radical excision gives the only permanent relief. He states that the removal of the diseased lip should be the first step of the operation, and not the submaxillary or cervical glands. He believes in a wide excision, and as complete a removal as possible of the submaxillary glands and lymph nodes, regardless of evidence of their being involved. The V-incision should have no place in modern surgery, and the semilunar incision is also objectionable. In fact all of the standard methods of operation are objected to by Grant, and he offers the following:

"The growth is excised by rectangular incisions, the base uniting the two vertical incisions being ordinarily in the depression, or crease, between the apex of the chin and the lip. From the two inferior angles of the wound incisions are made obliquely downward and outward, dividing all tissues, including the mucous membrane, and crossing the

¹ American Journal of Surgery, 1916, xxx, 17.

² Journal of American Medical Association, 1916, lxxvi, 1368.

maxillary line at a point about equidistant between the angle of the maxilla and the symphysis, and then carried backward beneath the maxilla as far as may be necessary to permit the easy removal of the glands, and at the same time afford good flaps for the mouth. Stenson's duct is never cut. The operation is repeated on the opposite side and all glands are cleaned out, the submental by a vertical incision between the anterior belly of the digastric muscles.

"The cheeks are then separated from the maxilla, at least as far as the masseter, if necessary. The facial arteries are cut, but the parts are vascular and the blood supply ample. The flaps are then brought forward and first united to each other with silkworm gut in the middle line. If flaps should be too broad to fill the space accurately, they can be retrenched from the inferior border. If there is much tension, a mattress suture is inserted and tied over gauze. This removes undue tension from the middle suture line.

"Stitches of silkworm gut or a running stitch of chromic gut are next applied to the lateral incisions. They should include the entire thickness of the cheek. If half or more of the lip is removed and the mouth does not now admit, without stretching, three fingers of the hand flat, then the mouth is enlarged by an incision backward and slightly downward, from each angle of the mouth, usually from one-half to three-quarters inch in length, down to the buccal mucous membrane, and the latter separated from the overlying tissues above and below the incision to the extent of half an inch. The lip above and below is now beveled from the inner border of the incision in order to facilitate easy covering of the lips by the mucous membrane, which is now divided with scissors in the middle line, nearly to the angle of the skin incision, and united to the skin by a running stitch of chromic gut.

"When it is necessary, from the extent of lip removed, to employ this additional procedure, the levator angulæ muscles are divided, and, in consequence, the upper lip will tilt slightly for two or three months. While this is not a serious matter, being opposed by the depressors, still I am in the habit of cutting away a small wedge of skin and muscle from the upper side of the wound, with the apex at the angle of the mouth, in order to limit this temporary inconvenience. Further, to control the action of these and the superioris muscles during the healing process, I apply a strip of adhesive plaster from cheek to cheek across the upper lip. The levators may be put out of action temporarily by subcutaneous division.

"A small rubber drain is inserted from the posterior angle of each lateral incision beneath the maxilla and a T-drain through each submental incision into the mouth, under the tip of the tongue. The T-end rests behind the incisor teeth and the outer end is fixed by a safety pin. This drain is especially important and limits the soiling of the wounds. Without it, saliva and mouth and throat secretions would constantly

bathe the lips and wounds, and might interrupt prompt and satisfactory healing.

"Though the upper lip is seldom affected by cancer, the same principle and operative technic will apply that has proved so satisfactory in the lower lip. Rectangular incisions for the removal of the growth and oblique incisions upward and outward for the formation of flaps, will satisfactorily meet the indications and necessities of the case. If the triangular-shaped flaps thus formed are united while being held in downward traction, and at the same time stitched to the fixed tissue beneath the maxillary spine, the short upper lip frequently observed will not result, and this procedure, I may add, will prevent the short, concave lip so common after the ordinary hare-lip operation."

X-RAY IN CANCER OF THE LOWER LIP. As a contrast to the above, I abstract the following from some conclusions by Boggs:¹

"Early surgical removal, wide and radical, has proved insufficient, because a recurrence takes place in over 50 per cent. when there is no glandular involvement, and in over 75 per cent. when there is glandular involvement. Many believe that radium and x-rays are equal, and even better, than surgery."

He does emphasize, however, the necessity for treatment by skilled workers.

Cancer of the Mouth and Tongue. Horsley² reports upon 8 cases, giving the history in detail and, in most of the cases, photographs of the patients. All of the 8 cases were advanced, and 7 were late, with either a recurrence of a previous operation or incision, or marked involvement of the glands of the neck. Three of the cases are apparently cured, and have been operated on thirteen months, three years, and three years and eleven months respectively. It is interesting to note that 3 patients had had an incision made for diagnostic purposes, with operation done several days later, and none of these patients are living.

Carcinoma of the Nasopharynx. Gatewood³ states that in 1904 Laval was able to collect only 27 instances of primary carcinoma of this region, and since that time there are only 26 additional reports.

They originate in the vault or on the posterior wall, and seem to go through a rather long latent period. Ulceration soon begins, and, later, the tumor appears, irregular, fungus-like, gray, and covered by exudate.

Extension may take place in four directions:

"1. *The Inferior or Pharyngeal Route.* The soft palate is rapidly invaded. Difficulty in alimentation is then the chief cause of the cachexia.

"2. *Lateral Prolongation.* This route is not very frequent. The tumor may invade the Eustachian tube early. When this occurs, there

¹ Interstate Medical Journal, 1916, xxiii, 117.

² Southern Medical Journal, 1916, ix, 512.

³ Journal of American Medical Association, 1916, lxvi, 499.

is, sooner or later, a middle-ear disorder on that side, which in several instances has been the initial symptom.

"3. *The Anterior or Nasal Route.* There is readily growth forward with invasion of the sphenoidal, frontal, and ethmoidal sinuses. By this route the tumor may involve the brain, penetrating into the anterior cerebral fossæ with termination in an enormous intracranial tumor. The maxillary sinus and orbit may be invaded. In the event of such extensive anterior growth there is intense pain referred to the terminals of the upper divisions of the trigeminal nerve, due to pressure by the tumor on these nerve trunks.

"4. *The Posterior or Cranial Route.* This is not common. The tumor may invade the brain secondarily. There is erosion of the bone (Lotzbeck), compression of the brain, extreme persistent headache, ocular disturbances, exophthalmos, stasis in the ophthalmic veins and other symptoms of tumor of the base of the brain."

It is interesting to note that Gatewood observes that carcinoma of the nasopharynx very rarely produces visceral metastases. They infiltrate, disintegrate, and destroy the neighboring tissue and cause very glandular metastases. Yet in spite of the local character of the lesion, most authors conceive that radical surgical treatment is never indicated. He further remarks that no certain cure is recorded.

Tuberculosis of the Tongue. Durante¹ reports 5 cases from the Mayo Clinic and reviews the literature. This disease is frequently confused with epithelioma or with syphilis, and in at least 5 cases amputation has been done under the impression that the operator was dealing with the former lesion, while in 180 reported cases the patient was subjected to mercurial treatment because of the supposed diagnosis of syphilis. Durante therefore urges that ulcers on the tongue should be subjected to histological examination and guinea-pig inoculation, especially if they are on the tip of the tongue and very painful. In the cases reported, two ulcers were treated by excision and three by the cautery.

THE NECK.

Dislocation of the Cervical Vertebra. It is generally believed that dislocation without fracture is common in injuries of the vertebræ above the level of the seventh cervical. Jonas² states that such is not the case in his experience, because the x-rays generally revealed a breaking off of a fragment of the transverse or spinous process or a part of the articular surface. He reports one case, however, which was a dislocation without fracture, and the injury was received at the hands of an osteopath during treatment. During the manipulations the patient suddenly felt and heard a loud painful snap at the back of his neck at

¹ *Annals of Surgery*, 1916, lxiii, 143.

² *Ibid.*, lxiv, 248.

the base of the skull, his head becoming fixed. This occurred one year before Jonas saw him, and during this time he had unbearable pain at the back of the neck and occiput, and inability to separate his jaws enough to eat or speak with freedom. Examination showed that attempts to rotate the head caused marked muscle spasm and certain physical signs denoting a luxated cervical vertebræ, probably the first one, the atlas. A skiagram showed a retrodisplacement of the atlas. It was thought that the occipital condyle, probably the left one, had slipped forward so that it rested in front of the margin of the left superior articular surface of the atlas, causing a fixed, rotary anterolateral flexion of the head. It was agreed to attempt manual reduction, and, if unsuccessful, to perform an open operation. Under ether anesthesia, guarded rotary manipulations with pressure were carried out without results. The usual posterior incision for laminectomy was made and the arch of the atlas, together with the left superior articular surface, was removed with rongeur forceps. A portion of the right atlo-occipital articulation was removed in order to mobilize the head. The operation was then terminated. The immediate effect was to permit the raising of the head so that the chin was free from the chest, enabling him to speak and masticate freely. There was moderate rotation. Pain and muscular rigidity had disappeared. The head could be elevated to the normal position, but the patient was unable to maintain it for more than a few minutes.

In this case the patient had been subjected to a succession of treatments intended to replace an imaginary "misplaced vertebra." Little by little the ligamentous attachments were stretched so that when the last ones yielded the displacement was complete and a real dislocation was established in place of the imaginary one.

Branchiogenic Fistula. This subject, together with that of branchiogenic cysts, has been referred to several times in these pages, and Speese has reported the cases from our clinic. Complete fistulæ seem to be rare, they have internal openings near the tonsils, and external openings at, or near, the anterior margin of the sternomastoid muscle somewhere between the hyoid bone and the clavicle. They are lined with epithelium, cylindrical at the inner end and squamous at the outer end. The treatment of such a fistula is well described by Dowd.¹ The method of procedure in his cases was as follows:

"Under ether anesthesia a ureteral catheter was passed through the external opening upward to the region of the hyoid bone. An incision was then made so as to leave a disk of skin about the margin of the opening and to extend upward and backward nearly to the angle of the jaw. Flaps including the platysma were then separated on each side and the wall of the sinus was exposed to view—it lay on the deep fascia

¹ *Annals of Surgery*, 1916, lxiii, 519.

parallel to the sternohyoid muscle, and was astonishingly distinct. It resembled a large vein, but was not dark colored. It was easily separated from the fascia as far upward as the hyoid bone. When its lower end was abducted the ureteral catheter passed easily into the pharynx near the lower end of the tonsil. The upper part of the sinus wall was then separated from its attachments close up to the pharyngeal muscles. It passed beneath the anterior belly of the digastric muscle. Its attachments were so lax that neither the hypoglossal nor glossopharyngeal nerves were seen. The separation was so satisfactory that the inversion of the upper end of the tube into the pharynx seemed possible (as suggested by von Hacker).¹ The fistulous tube was therefore cut off about three-quarters of an inch from the pharynx and a stitch taken in the distal end of the remnant and fastened to the catheter. The catheter was then withdrawn through the mouth and the end of the fistulous tube following it was inverted into the pharynx. It frayed away and separated at the margin of its pharyngeal opening. Its complete removal was therefore accomplished."

In some cases the fistula is densely adherent to the great vessels of the neck, making dissection difficult, and in these cases Dowd states that König frees the distal end of the fistulous tube as far as he can and then passes this free end through the mucous membrane in front of the tonsil and stitches it there, thus leaving a curved sinus, with an internal opening at each end—the posterior one pharyngeal, the anterior one buccal.

Tuberculosis of the Cervical Lymph Nodes. We have several times had occasion to report and comment favorably on the papers by Dowd, believing, as we do, that in the average case the patient is more quickly and more certainly cured by operative interference than by the use of tuberculin and the x-rays. It is a pleasure once more to welcome a contribution by Dowd.² He reports on 687 cases operated upon during the past twenty-two years, and followed with great care. He divides the cases into groups as follows:

Group 1. The early stage of lymphatic neck tuberculosis, the process still being local and extended very little beyond the upper group of lymph nodes (Fig. 2). Of the 687 patients, 452 were observed in this stage. Of the patients traced, 91 per cent. were apparently cured when last seen; 8.75 per cent. showed slight evidence of recurrence; 0.25 per cent., that is, 1 patient, had died of typhoid fever; 8 per cent. had secondary operations during the period of observation.

Group 2. The nodes along the entire jugular vein and those along the trapezius border become affected, and often there are sinuses or abscess formation (Fig. 3). There were 185 patients in this group, and their average age was 15.9 years, nearly double that of the first group.

¹ Centralblatt f. Chir., 1897, p. 1073.

² Journal of American Medical Association, 1916, lxvii, 499.

Of the patients traced, 68.2 per cent. were apparently cured when last seen; 5.5 per cent. had died of intercurrent disease, partly tuberculous; 2.4 per cent. 3 patients, died in the hospital, 2 from hemorrhage and 1 from thrombosis; 28.5 per cent. of the traced patients had two or more operations.

Group 3. These are the patients with but little resistance to tuberculosis. The neck infection quickly involves a great number of nodes, and there are usually evidences of tuberculosis in other parts of the body. There were 50 patients in this group. Their average age was

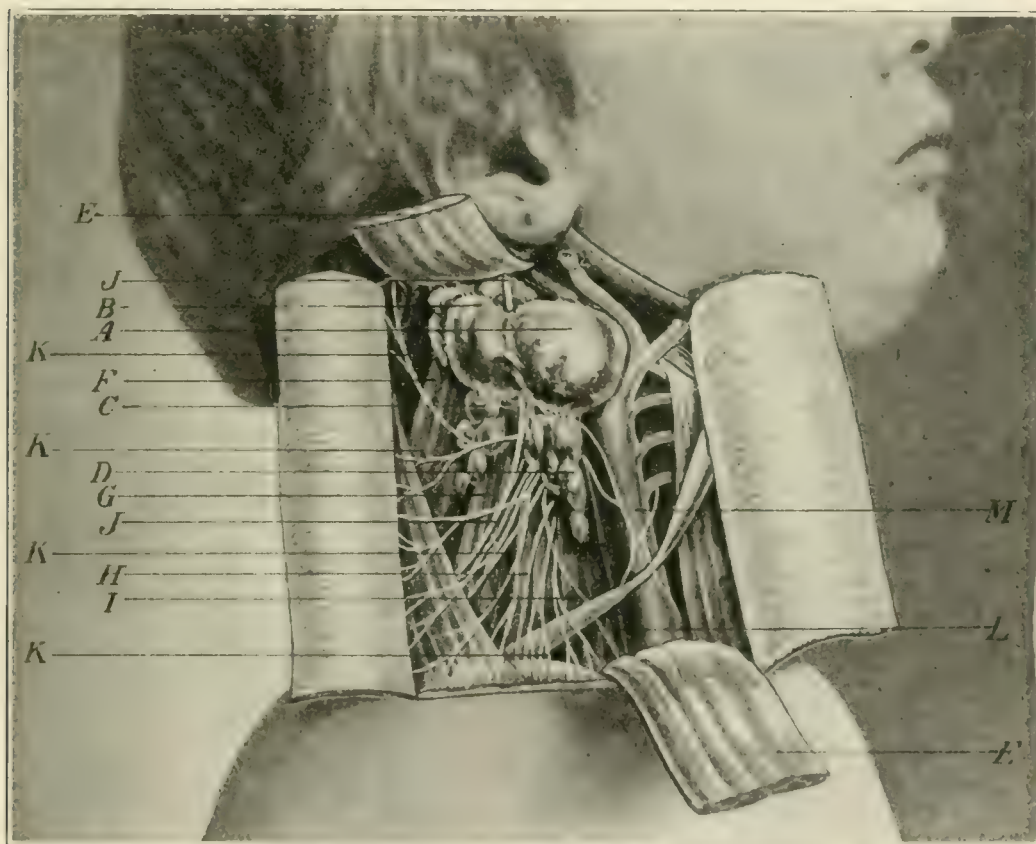


FIG. 2.—Early stage of tuberculosis of the neck lymphatics: A, tonsillar node, caseous; B, tuberculous nodes of the subparotid group; C, posterior nodes; D, nodes of the deep jugular chain; E, E', sternomastoid muscle; F, levator anguli scapulae muscle; G, scalenus posticus muscle; H, scalenus medius muscle; I, scalenus anticus muscle; J, J', spinal accessory nerve; K, K, K, K, branches of the cervical plexus; L, phrenic nerve; M, internal jugular vein.

12.7 years, about midway between Groups 1 and 2. Of the patients traced, 34 per cent. were apparently cured when last seen; 43.2 per cent. were suffering from recurrences or other forms of tuberculosis; 20.4 per cent. had died of intercurrent disease, largely tuberculosis; one patient died in the hospital soon after a minor palliative operation.

Dowd then properly calls attention to the necessity for making a proper diagnosis of tuberculous adenitis because of the great number of enlarged glands diagnosed as tuberculous and which are merely hyperplastic. He also notes with astonishment the class of cases which are

cited as operative failures. If the incision of an abscess or the removal of a single node is called an "operation" we shall have very poor operative results; but if the term "operation" means the removal of all the enlarged lymph nodes in the neck, we shall have very good operative results.

Very sensibly, he states that patients should have the advantage of such forms of treatment as are likely to help them, but they should not be allowed to drag from stage 1 to stage 2 while indefinite forms of treatment are being tried, nor should they be kept under treatment

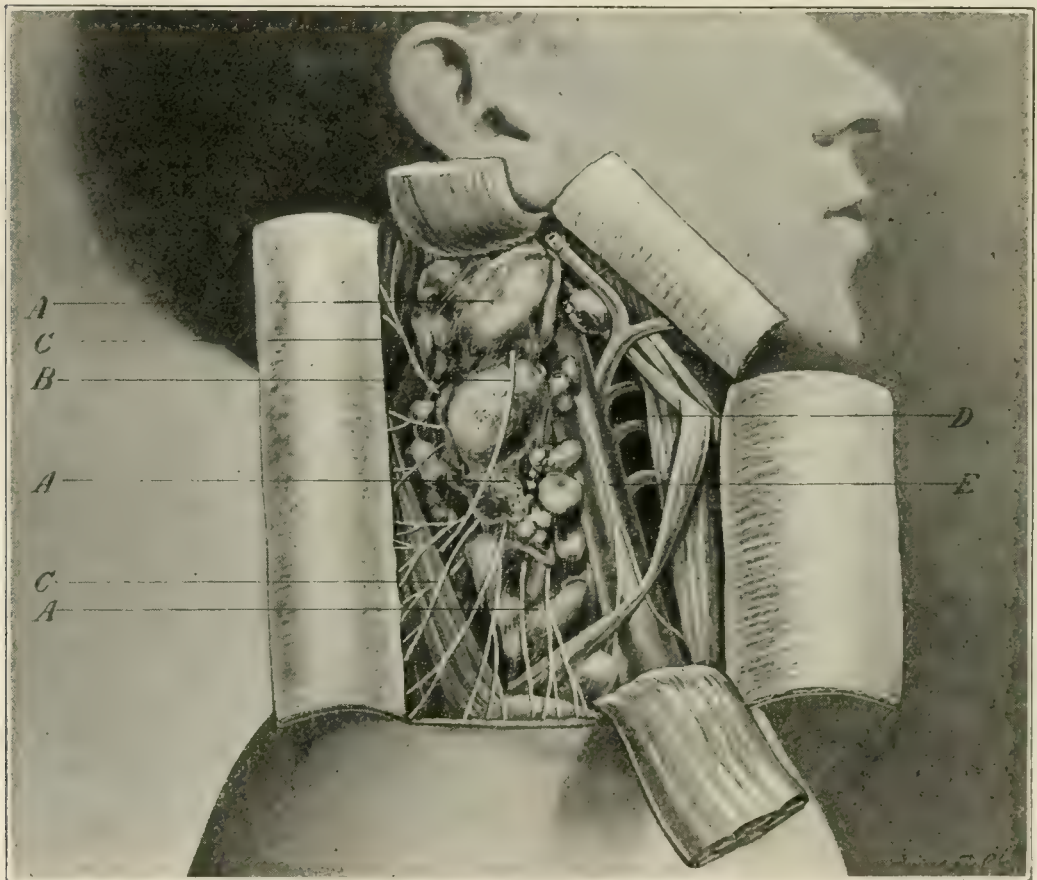


FIG. 3.—Late stage of tuberculosis of neck lymphatics: A, A, A, tuberculous lymph nodes; B, spinal accessory nerve; C, C, branches of cervical plexus; D, internal jugular vein; E, communicans hypoglossi nerve.

for months, or even years, with discharging sinuses, when a forty-minute operation and ten days' after-treatment would result in cure.

In the discussion on this paper, Golden, probably speaking for the Murphy Clinic, and Morris spoke in favor of tuberculin treatment, of the injection of the abscesses and of their incision, and of the *x*-rays. As Morris states, "It is a slow process and requires patience on the part of the patient." Dowd took exception to the statement of Golden that glandular enlargements in children's necks tend to subside, and also mentioned having visited tuberculin clinics where there were more patients than in any other part of the institution to which it belonged.

X-RAYS IN TUBERCULOUS ADENITIS. In an interesting paper by Boggs,¹ great claims are made for this method of treatment. He states that "when a chain of lymphatic glands is properly rayed the glands undergo fibrous degeneration, with almost entire obliteration without seriously influencing the surrounding tissue. If the glands are diseased the reaction of the epithelial cells is much quicker and more marked. Since diseased cells are less resistant to the rays than the normal, it can be readily seen that the same amount of radiation which destroys the diseased cells may seem to stimulate the surrounding healthy tissues. When chronic tuberculous glands with periadenitis are treated, they may disappear entirely, or they may only become smaller and be reduced to fibrous nodules which do not entirely disappear. The result is that the glandular mass shrivels up, certain glands cease to be palpable, while others remain as small, fibrous nodules, in most instances free from tuberculous foci. In some cases that he has treated these fibrous nodules were removed and examined and no active process found. He has a radiogram which shows how nicely a large tuberculous mass in the cervical glands disappeared, leaving a few deposits like the calcareous glands so often seen in the lungs after active tuberculosis.

Boggs believes that surgery should be reserved in most instances for cases which have been first treated by the *x*-rays, and for the removal of fistulous tracts caused by a suppurated gland which had broken down after a few *x*-ray treatments were given. He states that the papers by Stone, Dowd, and Müller are strikingly in contrast to this tendency. Dr. Müller wrote his paper from my clinic. To these names we might add that of Mathews who has had a large experience in the surgery of children, and Jopson who has had a similar large experience. The papers of the above-mentioned writers furnish the best arguments against the futility of *x*-ray treatment in the average case.

Hodgkin's Disease. Yates² believes that the old Trousseau classifications into three stages is correct, the first, or latent, stage being marked by a period of malaise or slight anemia; the second, or progressive, stage develops rapidly or slowly, and produces increased malaise, low fever, and anemia; the third, or cachectic, stage is marked by emaciation, extreme anemia, great physical and physiological disability and almost constant fever.

The anemia is of a secondary type, and may approach the primary form in extreme cases, and is the result of the hemolytic action of the toxin. He believes there is justification for the assumption that the *Bacillus hodgekini*, or closely related organisms, provoke a series of reactions that have common clinical manifestations. Three well-marked stages, peculiar tissue and blood changes, and a fatal termination. Variations in the clinical picture are held to be attributed in part to

¹ New York Medical Journal, 1916, ciii, 1016.

² Colorado M., 1916, xiii, 39.

differences in the toxins of the several kinds of organisms thus far secured, and in part to the differences in the resistance of infected individuals and the method of infection. Yates also believes that no diagnosis is positive until at least two or three diagnostic factors—blood, histological, and bacteriological—are positively established.

In regard to treatment, Yates believes that the portal of entry, and especially the tonsils, should be removed, and that all of the affected tissue should be removed as completely as possible. The operation should be followed by *x*-ray exposures hygienic measures, and the intravenous administration of immune serum. This after-treatment must be continued relentlessly for years if ultimate cure is to be obtained. He believes that arsenic, salvarsan, *x*-ray treatments, partial incisions, autogenous vaccines, etc., are useless. The *x*-rays must always be given as an adjunct measure, and partial operations are as ill-advised as in cancer.

Moore¹ reports his results in immunological studies of Hodgkin's disease. He found that horses can be immunized by repeated intravenous injections of pleomorphic diphtheroid bacilli isolated from the lymph glands in Hodgkin's disease. By refining this serum, according to the methods employed in concentrating diphtheria antitoxin, it was found that although no definite increase in the complement-fixing antibodies could be demonstrated, an increase in agglutinin could be shown. The refined serum produced fewer allergic reactions than the whole serum.

Two cases of Hodgkin's disease are reported by Smoot and Carrell.² The first case was given an autogenous vaccine for a period of ten weeks, pushing the dosage as rapidly as reactions would permit. There was no appreciable effect on the growth of the tumor, and the patient died from toxemia and pressure. The second case had five doses of a polyvalent vaccine, in sensitized horse serum. The first dose, 200 m., gave a nice reaction. There was a reduction in the size of the glands, but the patient would not take nourishment, and died from exhaustion.

Carotid Tumors. In *PROGRESSIVE MEDICINE* for March, 1914, I reported a collection of 60 cases of this unusual condition. I notice that Siple and Lynn,³ in reporting another case, state that 5 additional ones have been reported, bringing the total up to 66. In their case, a young girl, sixteen years old, developed a tumor on the right side of the neck, deeply seated and about opposite the hyoid bone. There were no symptoms other than the lump. At operation it was found that the common carotid artery tunneled the growth and that the internal jugular vein was firmly incorporated in the mass. These vessels were ligated above and below the growth and the mass lifted out. The

¹ *Journal of Infectious Diseases*, 1916, xviii, 569.

² *Texas Journal of Medicine*, 1916, xi, 529.

³ *Journal of American Medical Association*, 1916, lxxvii, 1602.

patient developed an extremely rapid pulse, but beyond this convalescence was uneventful. She was seen five years later, and at this time there was no evidence of recurrence.

In an interesting report by Winslow¹ 2 additional cases are reported, and 10 cases collected from the literature since the papers by Callison and MacKenty. Winslow reports that, leaving out of consideration the uncompleted or exploratory operations, there have been 59 cases in which the tumor has been extirpated, with 12 deaths, or a mortality of 20 per cent. In 34 cases reported, either all three carotids or the common and internal carotid were ligated and excised, with 11 deaths, or nearly 33 per cent. fatality. Only two or three recurrences are noted. In 25 cases in which the common or internal carotids were not ligated, 24 recovered from the operation and only 1 died, but speedy recurrence occurred in 8 cases.

Russell² reports 1 case in a girl, twenty-five and a half years old, who had first noticed the growth at the age of fourteen. In addition to the tumor the patient complained of a roaring sensation, and the mass was elastic, compressible, and pulsating. The tumor was removed and the patient recovered.

Aneurysm of the Internal Carotid Artery. Shipley and Lynn³ report an example of this rare aneurysm, and state that Crisp mentions only 2 in a collection of 551 aneurysms. The patient was forty-one years of age and complained of a mass in her throat, of gradually increased dyspnea, a very great shortness of breath on exertion, some stridor, a persistent, irritating cough, and considerable difficulty in swallowing. On examination, a smooth elastic mass was found behind the posterior pillar of the tonsil, giving an expansile pulsation. The pulsation disappeared when the carotid artery was compressed.

At operation an incision was made just behind the angle of the jaw and the bifurcation exposed. The position of the internal carotid was occupied by an oval, pulsating mass. As permission had not been obtained for the ligation of the artery, the wound was closed, but ten days later the artery was again exposed and a ligature applied. The patient made an uneventful recovery. The roaring noise in her ear immediately disappeared and pulsation in the mass ceased. One year afterward the mass was still present, although slightly smaller and without pulsation; the symptoms of pressure, cough, shortness of breath, and dyspnea had largely disappeared.

Arteriovenous Aneurysm of the Subclavian Artery and Vein. An example of this unusual condition is reported by Berkley and Bonney.⁴ The patient had been struck by a rifle bullet just outside the axillary border

¹ *Annals of Surgery*, 1916, lxiv, 257.

² *Journal of Missouri State Medical Association*, 1915, xii, 521.

³ *Journal of American Medical Association*, lxvii, 1602.

⁴ *British Medical Journal*, 1916, i, 753.

of the right scapula near its inferior angle and emerging just above the middle of the right clavicle. He had developed a swelling, with a marked thrill heard as far as the bone of the elbow. The brachial plexus was also injured, and the right arm entirely paralyzed. The patient was operated on, and an angular incision made, one arm of which ran nearly parallel with the clavicle and the other followed the middle line of the sternomastoid muscle. The skin flap was dissected out and the external jugular vein ligated and divided. The deep fascia was then incised, but, in doing so, the aneurysm was opened and a great gush of blood followed. This was controlled by finger pressure. The clavicle was then resected and the subclavian artery easily isolated and divided just outside the origin of the thyroid axis. The scalenus anticus muscle was divided and this made it possible to insert the finger between the first part of the artery and the first rib, and raise it and the sac forward. The mass of tissue distal to the sac was then grasped by long forceps and the mass of tissue cut away. It consisted of the sac and the third, second, and part of the first portions of the subclavian artery. The exsected clavicle was then wired into position. Berkley and Bonney stated that they would not repeat this stage of the procedure, as they believed it had helped in producing the suppuration. The patient made a good recovery for ten days, suppuration occurring in the wound, and two days later a secondary hemorrhage occurred, followed by six additional ones, blood apparently flowing from a deep sinus, but could always be stopped by pressure. As the last hemorrhage was severe, a second operation was performed, and through a vertical incision the lower portion of the common carotid was exposed and the origin of the subclavian artery thus reached. It had been the intention to ligate the innominate artery, but, instead, ligation of the subclavian artery was found to be sufficient. The patient made a good recovery and the wounds healed.

Aneurysm of the Subclavian and Axillary Arteries. Swan¹ reports a patient wounded by shell fragments, one of which entered the chest below the clavicle. Six months later he returned to the hospital complaining of an aching pain in the left shoulder, and an oval-shaped swelling was discovered below the left clavicle, giving expansile expulsion of bruit but no thrill. At operation, the third part of the subclavian artery and the axillary arteries were exposed by an incision over the clavicle. It was necessary to resect the clavicle in order to expose the aneurysm. Both vessels were ligated and the sac opened. After the clot had been turned out, free bleeding occurred from a branch which entered the aneurysm. This bleeding was controlled by forceps which were left in position for five days. The recovery was uninterrupted, a regular pulse being present the day after the operation.

¹ British Journal of Surgery, 1916, iv, 169

THE THYROID GLAND.

Exophthalmic Goitre. ETIOLOGY. The reason for the recurrence of goitre has perplexed us ever since surgical attention was directed to this disease. It is well known that goitre is endemic in certain regions and localities, and we have long held to the old theory that substances in the drinking water were at fault. Recently, Ochsner¹ refers to goitre wells in Michigan and Illinois and to farmers' children who were free from goitre when living in a certain section and who developed goitre when moving to another farm. Hale² shows that on one side of the Columbia River goitre is common, on the other side almost unknown. Such observations as these are often published.

This year, however, we are confronted with a contradictory report. Hirschfeld and Klinger,³ working in Switzerland, report that rats kept in regions where goitre is endemic develop thyroid hyperplasia. But if these rats are given distilled or sterilized water to drink, they develop the goitre just the same, and, furthermore, if control rats kept in goitre-free regions are given water from regions where goitre is endemic, they do not develop goitre. According to Hirschfeld and Klinger the error in previous observations was in failing, by controls, to note that it is the region or locality factor, rather than the water offered, that determines the outcome. They look upon the disease as one of a pathological state of metabolism of as yet unknown character. Another investigation carried out by a group of workers,⁴ and bearing a foreword by Crile, investigated the iodine content of foods from different parts of the country. They found that the iodine content of foods grown in admittedly goitrous regions appears not to be lower than foods grown elsewhere.

These experiments are very interesting, and promise much for the elucidation of the problem in the near future. If we are still in the dark regarding the etiology of simple goitre, how much harder must the problem be in the case of the exophthalmic type (hyperthyroidism). Here also we are able to present some very significant studies.

Plummer (quoted from Kendall) has formulated the following basic hypotheses:

1. In thyroid disturbances, the effects are due to a change in the rate of a normal function.
2. The stimulating effect of thyroid activity is not felt in any particular set of organs or tissues alone, but the stimulus is active throughout the body.
3. The stimulating action is intracellular.

¹ *Annals of Surgery*, 1916, lxiv, 492.

² *Proceedings of American School Hygiene Association*, 1915.

³ *Arch. f. Hyg.*, 1916, lxxxv.

⁴ Forbes, etc., *Bulletin* 299. Ohio Agricultural Experiment Station, June, 1916.

In pursuance of the exact nature of the above, Kendall¹ reports some investigations on the *function of the thyroid-parathyroid apparatus from the chemical stand-point*. He has isolated from the thyroid a crystalline compound containing 60 per cent. of iodine, which, under proper conditions, deaminizes the amino-acids resulting from the decomposition of the body proteins. The function of the thyroid, therefore, is to furnish a catalyzer which regulates the rate of deamination. If the amount of iodine is increased, the speed at which the reaction takes place is increased, and the speed of reaction of all body functions is increased. In a second paper he² states that by the administration of this compound, thyroid activity can be followed experimentally and clinically. Given in very small amounts this substance will supplant thyroid activity, relieving the conditions of myxedema and cretinism, and, in excess, will produce symptoms simulating exophthalmic goitre. It appears to have no direct action on the pulse-rate of itself, but if amino-acids are injected at the same time, the pulse-rate is enormously affected. He also shows typical pictures of the good effects of treatment in myxedema and cretinism.

Kendall states that it seems indisputable that all of the effects produced by the thyroid are through its effects on metabolism, and DuBois,³ working clinically, makes the same statement. He found an increased basal metabolism with great regularity in exophthalmic goitre and in severe cases reaching a level found in no other condition. Measuring with the Sage calorimeter, he found, in very severe cases, an increase of 75 per cent., or more, above the normal average. He contends that mental and physical rest is the surest means of securing the drop in the metabolism, which indicates a diminution in the pernicious activity of the thyroid. It is interesting to note that ligation of the thyroid arteries, in 3 out of the 4 patients studied, caused a distinct rise in metabolism, the duration of which was uncertain. He emphasizes the necessity for administering large amounts of food to these patients. The reason is apparent. Bensley⁴ has also made an interesting contribution to the problem by studying the structure of the thyroid in relation to its function. He believes that the thyroid secretion (secretion antecedent) is ejected from the outer pole of the cells and that the intra-follicular colloid represents a stored secretion.

The various publications by Cannon⁵ are fascinating to read. Accepting the nerve supply of the thyroid as being derived solely from the sym-

¹ Journal of American Medical Association, 1916, lxvi, 811.

² Boston Medical and Surgical Journal, 1916, clxxv, 557.

³ Archives of Internal Medicine, 1916, No. 6, p. 915.

⁴ American Journal of Anatomy, 1916, xix, 37.

⁵ American Journal of Physiology, 1916, xli, 39, 58, 74; Journal of American Medical Association, 1916, lxvii, 1483; Boston Medical and Surgical Journal, 1916, clxxv, 562.

pathetic, and that they are true secretory nerves, he concludes that the thyroid is subject to that division of the nervous system which is brought into action in emotional excitement, and which causes adrenal secretion. By fusing the phrenic nerve with the cervical sympathetic he produced symptoms in animals similar to hyperthyroidism and relieved by lobectomy on the affected side. The basal metabolism of these animals was greatly increased. It was also found that the adrenal secretion, when increased, provoked a characteristic electrical change in the thyroid, and the adrenals are intimately connected with the sympathetic nervous system. He believes that the glands have an emergency function brought out in times of great excitement but protected by a high neuron threshold which, when worn down by frequent or great emotional experiences, allows a pathological state to occur. It will be recalled that Crile has performed adrenalectomy, as well as thyroidectomy, in the endeavor to break the chain of pathological stimulation.

The *relation between the clinical symptoms and the pathological findings* of the removed glands has been worked out by Plummer and Wilson, of the Mayo Clinic, in many studies, and the groupings suggested by them have been adopted by many surgeons. As is well known, they divide goitre into (1) hyperplastic toxic ("exophthalmic goitre"); (2) non-hyperplastic toxic, with high blood-pressure; (3) non-hyperplastic toxic with low blood-pressure; (4) non-hyperplastic questionably toxic, with low blood-pressure; (5) non-hyperplastic atoxic, with low blood-pressure.

In a recent study by Wilson and Kendall¹ a series of 566 consecutive cases has been examined to show the relationship of the pathological histology and the iodine compounds of the human thyroid. Of these, 141 were hyperplastic toxic (exophthalmic goitre); 79 were encapsulated adenomas, of which 44 were toxic; and 257 were simple goitres, of which 117 were toxic. The tables published from the Mayo Clinic must be examined closely in comparing with other statistics, as they do not consider exophthalmic goitre unless the clinical symptoms and microscopic evidence of hyperplasia agree. Kendall adds to the work of Plummer and Wilson the fact that the amount of iodine in the gland parallels the clinical groupings. If we recall Wilson's grouping of hyperplastic toxic goitre, we note that Kendall has found that the total iodine (in milligrams) in the portion of gland removed at operation was:

A. Early hypertrophy and hyperplastic	. . . . .	9.2 milligrams.
B. Advanced hyperplastic	. . . . .	3.4 "
C. 1. Early regression of hyperplastic	. . . . .	8.0 "
C. 2. Advanced regression of hyperplastic	. . . . .	14.2 "
C. 3. Very advanced regressed of hyperplastic	. . . . .	21.9 "

¹ American Journal of Medical Science, 1916, cli, 79.

In the encapsulated adenomas it averaged 10.9 mg.; in the common simple or colloid goitre (type H) the average was 23.9 mg. It is interesting to note that these non-hyperplastic groups reversed the iodine index as seen in the hyperplastic group. The clinically toxic forms showed a higher iodine content than the atoxic group. Further reports of work along this line are awaited with much interest.

It will be noted that over 50 per cent. (55.7) of the encapsulated adenomas were toxic. Goetsch¹ has attempted to solve the reason by a close cytological examination of the tissue removed in cases of goitre. Mitochondria granular rods or filaments occur in the cytoplasm of all cells, being more abundant in the active stages of cell life and diminishing in number as the cell becomes inactive or senile. In case of toxic goitre, with circumscribed fetal adenoma, the cells of the adenoma showed these mitochondria in greatly increased numbers. Furthermore, no increase was observed in adenomata removed from glands which were clinically inactive, and they were also markedly increased in frank cases of exophthalmic goitre.

Goetsch therefore concludes that it would seem probable that the presence of mitochondria in greatly increased numbers is directly correlated with an overproduction of an otherwise normal thyroid gland secretion.

Anatomy of the Thyroid. In view of the tendency of surgeons to remove more of the thyroid than they have done in the past when operating for the various types of goitre, the research by Poole and Falk² is timely in calling attention to the position of the parathyroids. They first discuss the relations of the surgical capsule. It is practically the same in the goitrous as in the normal neck, and is closely associated with the sheath of the cervical vessels. The most important point is the division at the posterior aspect of the lobe into two layers, one passing posterior to the esophagus, the other forward and mesially to the postero-external aspect of the trachea, and between them is the recurrent laryngeal nerve. If, in the performance of an intracapsular extirpation, or lobectomy, the capsule is torn in the region of the division into its two layers, the operation may follow the posterior layer and thereby endanger the nerve.

Sixty parathyroids were found in 25 postmortem bodies. They could be grouped as follows: Twenty-six (43.3 per cent.) lay external to the capsule and safeguarded in an intracapsular extirpation of the lobe; 9 (15 per cent.) were so placed as to be probably injured; 25 (41.7 per cent.) were so placed as to be certainly removed with the thyroid in an intracapsular extirpation of the lobe.

They conclude that since two parathyroids usually lie on each side, and inasmuch as two parathyroids can satisfy the demands of the body,

¹ Bulletin of Johns Hopkins Hospital, 1916, xxvii, 129.

² Annals of Surgery, 1916, lxiii, 71.

it is reasonably safe to perform complete intracapsular extirpation of one lobe. But, if a double lobectomy is contemplated, the posterior part of the lateral lobe must always be left on at least one side. It is even better always to leave the posterior part of the lobe in case a second operation is done at a future time. Such a procedure will also safeguard against injury to the recurrent laryngeal nerve. Barnhill¹ makes a similar plea.

De Quervain² also describes the fascias in relation to the thyroid gland in an even more complete manner than Poole and Falk, but the anatomical part of his paper is hard to abstract. Bearing upon the same points, his illustration is very elucidating (Fig. 4). Ochsner also

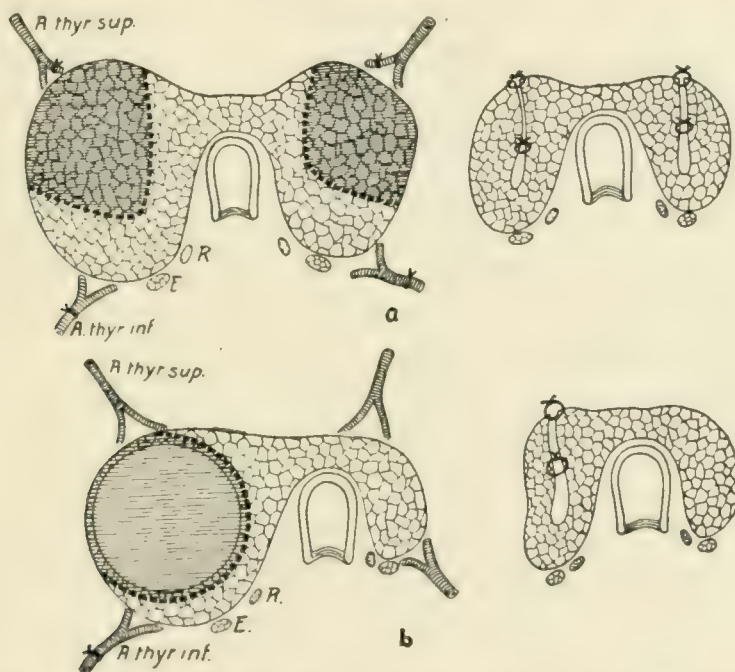


FIG. 4.—Plan of the goitre operation. *a* (above), resection of both lobes; *b*, one-sided enucleation; *R*, recurrent nerve; *E*, epithelial bodies.

follows the same plan in avoiding the nerves and parathyroids. De Quervain shows that while the danger to the sympathetic nerve is not great, it should be protected from injury by avoiding pressure on the vertebral column by retractors, especially in vessel ligations through small incisions.

Treatment of Non-toxic Goitre. (Simple goitre, colloid goitre, adenomas.) There is nothing new to add to the statement often reiterated that operation in these cases is most satisfactory. Dowd³ reports 63 cases operated on without mortality. The condition of 59 is known and entire cures can be recorded except in 1 case where a part of the remaining lobe had to be removed eight years later. C. A. Porter⁴ has

¹ American Journal of Surgery, 1916, xxx, 137.

² Surgery, Gynecology and Obstetrics, 1915, xxiii, 402.

³ Journal of American Medical Association, 1916, lxvi, 480.

⁴ Boston Medical and Surgical Journal, 1916, clxxv, 551.

had but one death in more than a hundred cases. In my clinic sixty-two of these non-toxic goitres have been operated on without mortality. M. F. Porter¹ believes that it should be the rule to remove all permanent goitres, whether they are producing symptoms or not. There is just as much reason for removing so-called simple goitres with a view to preventing them from becoming toxic, as there is for removing or curing warts, moles, chronic ulcers, etc., to prevent them from becoming malignant.

Surgical Treatment of Toxic Goitre. This disease belongs essentially to the domain of surgery, recognizing, of course, certain exceptions. To equivocate in this general assumption at the present time, and in the light of surgical accomplishments, is not admissible. The "non-surgical" treatment of the toxic goitre is attended with a higher rate of mortality, and among those supposedly cured, upon the patients' return to their normal habits relapses are indeed frequent. Add to this the inevitable complications which follow delay—disturbances of nutrition, permanent organic damage to the structures of the heart, the kidney, the adrenals, the exhaustion of the nervous system, the exophthalmos and possible loss of vision, the inevitable incapacitation in, if not actual abandonment of, occupation of every-day life work, and we have an array of facts which justifies a positive stand in favor of surgical, as compared with non-surgical, management of the disease.

We have become so accustomed to good reports from the clinics of Kocher and the Mayos that it is very gratifying to have some figures from other prominent clinics attesting to good results also. The following have been recorded by Judd and Pemberton,² Porter,³ David,⁴ Presbyterian Hospital, Chicago, Matlack,⁵ and Dowd.⁶

Judd and Pemberton	68.0 per cent. cured or practically cured.
Porter	69.1 per cent. cured or much improved.
David	78.0 per cent. cured or great improvement.
Matlack	70.0 per cent. permanently cured.
Dowd	70.4 per cent. great improvement.

It is interesting to compare these with the pessimistic attitude of Mackenzie,⁷ who states that, in his experience, operation in cases of exophthalmic goitre has, on the whole, been very unfavorable. It is small wonder that it is so, and we ourselves would be prompted to abandon operative treatment if we were accustomed to the results

¹ *Annals of Surgery*, 1916, lxiv, 395.

² *Surgery, Gynecology and Obstetrics*, 1916, xxii, 269.

³ *Boston Medical and Surgical Journal*, 1916, clxxv, 551.

⁴ *Annals of Surgery*, 1916, lxiv, 400.

⁵ *Ibid.*, lxiv, 487.

⁶ *Journal of American Medical Association*, 1916, lxvi, 480.

⁷ *Lancet*, 1916, ii, 815.

reported by him. They had a percentage of deaths amounting to 42 per cent. among the thyroidectomies, and 20 per cent. among the cases of ligation of arteries. He mentions the report from the clinics of Kocher and Mayo, but believes "they should be received with great reservation."

If to the group of cases reported by the above American surgeons we add those of Ochsner and my own,¹ we have 1415 cases, with 50 deaths, a mortality of only 3.5 per cent. This, of course, is the operative mortality only, because Judd and Pemberton, in reporting the cases operated in 1909, 176 in number, had an operative mortality of 4 per cent., but on tracing the cases they found a total mortality of 12 per cent.

It is difficult to clearly state just what cases should be operated on and in which operation should be avoided for fear of the risk.

Porter states that all cases of Graves's disease should first be treated by rest and medical treatment. If satisfactory improvement occurs, this may be continued, but is not applicable to wage-earners and those who cannot give up the time. Operation should be resorted to when improvement is unsatisfactory under medical means; in cases which have already lasted more than a year, with commencing myocardial weakness, exophthalmos, etc., or when it is unlikely that medical treatment will act sufficiently quickly to bring about a satisfactory result. Ochsner has stated similar opinions, and I² have formulated the following plan in determining the appropriate line of treatment:

We must make an arbitrary distinction between cases of moderate severity and those of a more serious nature. My advice to patients with a moderate thyrotoxicosis depends upon their financial and social status. If conditions are such as to make it possible for them to undergo a prolonged period of rest, both physical and mental (the most influential and beneficent of all non-surgical measures), to have a complete change of environment, and, what is of vital significance, if it is necessary for the patient to return immediately, after the course of treatment, to conditions of employment or environment that predisposed toward the development of the disease, or would predispose to relapse, I strongly urge immediate recourse to operation.

Certain cases are not good risks. Porter's experience teaches him that exophthalmic goitre is graver in excitable girls from eighteen to twenty, in women from forty to fifty, apparently passing through the menopause, Hebrew women, and chronic types. In the latter, often of years' duration, with ups and downs—exophthalmos, firm vascular glands, tachycardia, arrhythmias, the patient may be suffering from the aftermath of a passed toxemia, and it is often a nice question of judgment to decide for or against operation. He advises, in such cases, to estimate the carbohydrate tolerance, basal metabolism, differential blood

¹ Pennsylvania Medical Journal, 1916, xix, 231.

² Ibid,

count, adrenalin tests, etc., to determine, if possible, whether the symptoms are really due to an overactive gland.

I believe that, confronted with a grave form of thyroid intoxication, the watchword should be caution. In the first place it is quite out of the question in most instances to express an opinion as to what the order of treatment should be until the patient has been under observation for at least a few days, preferably in bed. The agitation of an already overwrought individual on the occasion of the first consultation may give one an entirely different impression of the gravity of the case as compared with that obtained after complete rest in bed and the patient's reaction to the conditions of the new environment. During the period of observation I investigate first the circulatory, a compensatory hypertrophy, or an acute dilation of the heart, the high blood-pressure of early excitations or the low blood-pressure of a terminal stage, the relative number of lymphocytes. A radiograph may reveal a substernal enlargement or detect an enlarged thymus. The effect of rest upon the tachycardia is noted. The presence or absence of cardiac loss of compensation, of nephritis, of adrenal insufficiency, and of such conditions as may indicate that the stage of hyperthyroidism has passed into one of hypothyroidism must be inquired into. For one must be influenced in the selection of the operation by the nutritional disturbance, by the evidence of cardiac disturbances, and especially dilatation, by the duration of the disease, by the degree of muscular weakness, and by the mental stability.

Sloan¹ calls attention to the reduction of the alkaline reserve and to the studies by DuBois,² showing that the metabolism in severe Graves's disease is increased as much as 100 per cent. above normal. He states that the clinical signs of a low alkaline reserve are seen in the dark, cherry-red color of the lips, the inability of the patient to hold his breath more than forty seconds, and in the heightened respiratory action upon the mildest degree of exertion. He believes that the severe cases ought not to be subjected to an immediate lobectomy, but that from two to ten weeks should be allowed to pass, and during this time such minor procedures as the injection into glands of quinine and urea, the injection of boiling water, or the ligation of the superior thyroid arteries, with their accompanying sympathetic nerves, should be performed. He follows the method of Crile in eliminating the psychic factor of fear by anoci-association.

It might be mentioned in passing that Watson³ recommends quinine and urea injections to relieve hyperthyroidism. Sloan also discusses the relation of certain clinical types to treatment.

¹ Cleveland Medical Journal, 1916, xv, 453.

² American Journal of the Medical Sciences, 1915; cli, 781.

³ New York Medical Journal, 1916, ciii, 791.

Adolescent Type. He distinguishes three varieties: (1) Where there is thyroid enlargement, hardly any intoxication, and the patient is able to perform work normally; here the gland is compensating by its hypertrophy; (2) the type showing the border-line case with loss in weight; (3) the heavy type often associated with acne and seen principally in boys with heavy, thick necks. They keep their weight well but easily tire, and have a rapid heart action and general excitability. Investigation of the intestinal tract often finds it at fault. The results of operative treatment are disappointing.

Cold Graves's Disease. This type occurs principally in women, and generally in those with constipation, headache, and other symptoms referable to stasis. They are nervous, mentally depressed, and chronically tired. They have thyroid enlargement, gradual and progressive loss of weight, rapid heart action, sallow skin, cold hands and feet, and slight coarse tremor. The picture is also seen in tired mothers, who have borne children rapidly and are worn out. Sloan states that this type of patient demands rest, both physical and mental, with attention to intestinal elimination, and the intake of proper food.

Hypertonus and Old Colloid Goitre. These individuals have the nervous excitability and the tremor, but show little loss in weight. They have a high systolic pressure, the heart is universally enlarged, and the impulse may be irregular, forced, and arrhythmic showing the underlying weakness of the heart muscle. The pyknoecardia makes one certain of the thyroid factor concerned in the disease. Thyroidectomy gives immense relief to these people, but the heart must be carefully supported by digitalis before and after operation.

It is neither desirable nor possible to formulate a set of rules governing the indications for the several procedures to be considered—boiling water injections, ligation of one or more vessels at one or several sittings, partial thyroidectomy. Each case presents its own peculiar problem and must be dealt with as such. After one has had a reasonably large experience in dealing with these explosive creatures he finds himself becoming more conservative rather than radical in his practice, and I believe it is a good working rule, whenever in doubt, to err rather on the side of conservative methods. For example, in the grave case, if one is at all in doubt as to whether to remove a lobe or to ligate, always ligate, and if in doubt as to the choice of ligation or boiling water injections, adopt the latter. The course of treatment may be thus prolonged, and the final effect be so much delayed, but fewer lives will be sacrificed. It is the better judgment as to the selection of cases and of the method and time of operation that is the keynote to success and the cause of the low mortality.

Ochsner also speaks of working in this way, and says that "it is in determining the extent of the operation that the patient can safely bear

that the surgeon has an excellent opportunity of showing surgical judgment in treatment of these cases."

In regard to ligation, Ochsner believes that this operation has been more effective if the regular horseshoe incision is made and if the large veins located anteriorly to the thyroid gland are all clamped and ligated, as well as the superior and inferior arteries, and veins on the side of the gland most affected.

C. A. Porter also makes some interesting observations about ligation. He believes that the second operation is made harder, owing to adhesions, and the vascularity of the gland is not much diminished by ligation of the superior vessels. He thinks the benefit which frequently follows is due to division of the sympathetic nerves accompanying the vessels. In 2 cases only did ligation bring about a cure. He believes that after ligation of the superior vessels there seems to be, after ten days or two weeks, a diminished danger in operation, but if there is any lengthy lapse, the risk seems to be that of a primary thyroidectomy.

Judd and Pemberton also believe that the preliminary ligations should nearly always be followed by thyroidectomy, and that when ligations are done, late recurrences are much more common.

In my experience I have found that improvement may be so considerable after ligation that the patient is satisfied and declines further treatment. In one extremely toxic case recovery seemed complete. However, the maximum improvement is reached, on an average, by the third month, but is not always maintained; if the patient returns to an exacting occupation and puts off the thyroidectomy, there may be relapses of varying degrees.

The general principles underlying the technic of thyroidectomy are well understood, but in the case of the toxic goitre the question as to how much of the gland is to be removed is a pertinent one. In most cases both lobes are involved with the same hyperplastic process, so that all of the lobe, the isthmus, and two-thirds of the other lobe must be removed. Generally speaking, less gland is physiologically required in the old than in the young; the nearer the menopause, the greater the proportion of glandular tissue that may be removed with impunity. I find myself, with increasing experience, removing more rather than less tissue, and thus far have seen better immediate and no harmful ultimate results. If but a remnant of gland is left, and the human economy demands more of the thyroids' internal secretion, I believe a compensatory hyperplasia will occur sufficient to make up the deficit. This has been shown experimentally by Halstead, and is confirmed by clinical observations.

M. F. Porter believes it is better judgment to remove a larger part of the gland than is usually done; he has removed from five-sixths to nine-tenths of the gland in more than 100 cases, and in none, so far as he knows, has there been either recurrence or symptoms of hypothyroidism. Of

course, this relatively complete thyroidectomy is not advised in cases wherein it adds seriously to the risk of operation. C. A. Porter states that while double partial lobectomy is a more severe and bloody operation than hemithyroidectomy, he had noted in his cases that more immediate improvement takes place, and the danger of recurrence of symptoms is less. A similar trend of thought seems to prevail at the Mayo Clinic, for Judd and Pemberton, in discussing secondary resection for recurrence, state that "these results tend to bear out the impression that if the patients are not cured it is because enough of the gland has not been removed. Sloan states that it has been his practice to take out four-fifths of the thyroid gland in the severe cases, and that the tendency is to increase the amount of this resection rather than to diminish it. In those cases in which there has not been sufficient of the gland removed, they may require a second operation. Persistent force of the heart beat and palpable pulsation in the thyroid vessels are clinical symptoms giving the indication for further thyroid removal

It is a curious fact that there is no consensus of opinion upon the selection of an *anesthetic*. Looking the world over we see, in three large clinics, Kocher using local anesthesia, Ochsner using ether, and Crile, nitrous oxide. As each anesthetic is advocated in equally strong terms, the choice must be left to one's own judgment and experience. A strong argument can be made for general narcosis, as against local anesthesia, in all forms of toxic goitre, and an equally strong argument for nitrous oxide as against ether.

I believe absolutely in the application of the general principle of anoci-association, and I note that Ochsner and C. A. Porter also strongly emphasize this point.

Ochsner believes that if at the commencement of the operation the head of the table is well raised, the resulting anemia of the brain will keep the patient anesthetized for a sufficient period of time to perform the operation without additional ether. He always performs gastric lavage at the end of the operation in all cases with marked hyperthyroidism, as the mucus in the stomach seems to increase the hyperthyroidism. He also administers 400 to 600 c.c. of blood by transfusion in certain cases, injecting it into one of the anterior jugular veins during the operation. It increases the margin of safety.

I notice that C. A. Porter is "more and more in favor of local anesthesia, where the mental attitude of the patient is satisfactory." He gives sulphonal—grains 20 to 30—the afternoon previous to the operation, and one or two doses of morphine, commencing an hour and a half before the appointed time. With the second dose $\frac{1}{2}$ of a grain of scopolamine is given, and this may be repeated just before operation if the patient is not sufficiently drowsy."

Note, however, that Porter finds that "occasionally there is excitement instead of quiet, a condition like coma vigil, the patient sleeping

until the surgeon starts to do something, then waking up and resisting." In such cases he states that general anesthesia must be given with great care owing to the excessive drugging. For the anesthesia he uses a 1 or 2 per cent. novocaine solution with $\frac{1}{40.000}$ adrenalin chloride. The line of incision is so injected as to bring out a white wheal on the skin. He then reaches the nerve supply of the part—the cervical nerves at the posterior border of the sternomastoid muscle, from its midpoint downward for an inch and a half—by deep massive infiltration. Supplementary injections may be necessary, and time should always be given for them to act.

Porter discusses certain minutiae in the after-care, which is usually omitted in papers on goitre. He sutures the platysma with care and closes the skin with a subcuticular catgut suture or interrupted fine silk or horsehair loosely tied and removed within three days. A moist dressing, applied for twenty-four hours, allows oozing from the drain or between the stitches. He usually does not drain, but if he does, it is removed at the end of two days. I remove mine in twenty-four hours. He cautions about preventing infection from a loose dressing. If no drainage is used, in spite of careful hemostasis, there occasionally occur collections of bloody serum which have to be evacuated, and not infrequently one notices little collections, just under the skin, of a sterile bloody serum which has to be pricked like a blister.

After-treatment. I cannot do better than to quote the entire section of Ochsner's paper, bearing on this subject:

"By far the most important point in the surgical consideration of this condition consists in the after-treatment, because, with careful after-treatment, almost all of these patients may become nearly as useful as they were before they began to suffer from exophthalmic goitre, while in cases in which the after-treatment is not carefully carried out, practically all of these patients develop a condition as bad, if not worse, than that with which they presented themselves primarily for surgical treatment. The surgeon should bear in mind, in the first place, that practically all of these patients belong to a class of neurotics, and that this undoubtedly had much to do with the development of their goitres primarily, and that unless this condition is carefully taken into consideration in the after-treatment, the weakened physical condition of the patient will not be able to bear the wear and tear to which the neurotic tendencies would surely expose the patient. The same is true concerning the diet which is habitually chosen by the patients, which is usually exceedingly unwholesome, and it is consequently important that they be impressed with the fact that unless they will adhere to the use of a reasonable diet, their chances for permanent recovery will be very slight. We have always given these patients printed directions which contain all of the important rules to be observed, and we have advised the patients to read these directions at regular

intervals and to follow them for many years. The following is a copy of the directions which we use in these cases, and which have proved eminently satisfactory. The patient received a mild tonic and a laxative and an absolute diet list upon leaving the hospital.

Rules for Goitre Patients. "1. You should avoid all excitement or irritation, like attending receptions, shopping, church work, and politics.

"2. You should get an abundance of rest, by going to bed early and taking a nap after luncheon.

"3. You should have an abundance of fresh air at night, consequently you should sleep with wide-open windows or on a sleeping porch.

"4. You should eat and drink nothing that irritates the nervous system, like tea, coffee, or alcohol. Of course, you should not use tobacco in any way.

"5. You should eat very little meat. If you are very fond of meat, take a little beef, mutton, or breast of chicken, or fresh fish once or twice a week, or at most, three times a week.

"6. You should drink a great deal of milk or eat things that are prepared with milk, such as milk soup, milk toast, etc., cream and butter-milk are also especially good for you.

"7. You should avoid beef soup or beef tea or any kind of meat broths.

"8. You should eat an abundance of cooked fruits and cooked vegetables or very ripe raw fruits, or drink fruit juices prepared out of ripe fruits.

"9. You may eat eggs, bread and butter, toast, rice, cereals.

"10. You should drink an abundance of good drinking water, or if this is not available, you should boil your drinking water for twenty minutes or drink distilled water."

RELATION OF THE THYMUS GLAND TO GOITRE. The relation of the thyroid gland to other ductless glands should not be overlooked. Experimentally the removal of the thyroid may be followed by hypertrophy of the hypophysis, with increase of colloid, and by hypertrophy of the parathyroids. But the relation of the thyroid to the thymus is one of more than academic interest, and is not a matter of common knowledge. The reduction of thyroid tissue causes atrophy of the thymus, and hypertrophy of the thymus is associated with that of the thyroid; and, what is of still greater importance, the removal of an enlarged thymus will relieve the symptoms of a disordered thyroid. In a paper of absorbing interest by Halstead, on the significance of the thymus gland in Graves's disease, he refers to the spectacular case of von Haberer, who removed a thymus under local anesthesia from a patient desperately ill, with miraculous results. I bring up this thymus question merely to emphasize the fact that in some cases, not sufficiently relieved by thyroidectomy, a subsequent thymectomy may be indicated.

Mackenzie¹ states that during the past thirty-six years there have been exactly 36 postmortem examinations at St. Thomas's Hospital, London, on cases of exophthalmic goitre. The presence of the thymus was noted in 26 cases, and it was described as greatly enlarged in 6, large or hypertrophied in 16, and persistent but not large in 4.

Ochsner has not been able to make out the enlarged thymus gland as an accompaniment of hyperthyroidism. He has not been able to outline a thymus gland in his thyroid cases, although the *x*-ray plates have shown frequently that the hyperthyroidism is accompanied with enlargement of the thymus gland. C. A. Porter is more inclined to believe recurrence after ligature and lobectomy as due to late operation, with degenerations and changes in the sympathetic nerves or other glands, than to thymic activity.

SYMPATHETIC GANGLIA CHANGES IN EXOPHTHALMIC GOITRE. Excision of the cervical sympathetic ganglia first proposed by Jonnescu for the relief of exophthalmic goitre is rarely done at the present time except perhaps by its author. Last year I reported a paper by Charles Mayo, in which he stated that removal of the superior cervical ganglia was the best method of obtaining relief for the exophthalmos which, as is well known, is the most persistent symptom in exophthalmic goitre. This year I see that Wilson and Durante² have noted the pathological changes in the ganglia removed at operation from 16 patients with hyperplastic exophthalmic goitre. They found histological changes indicating various stages of degeneration and accompanying the more advanced changes in the ganglion cells with similar degenerative changes in the nerve fibers. They state that, in general, the pathological changes in the cervical sympathetic ganglia are parallel to the stage and intensity of the symptoms of hyperthyroidism and to the hyperplastic and regressive changes in the thyroid.

CEREBRAL NERVE DISTURBANCE IN EXOPHTHALMIC GOITRE. An unusual case and a review of the literature is reported by Heuer.³ It seems that isolated palsies of the cerebral nerves, with certain exceptions, are extremely rare. Five cases of paralysis of the facial have been reported and something over 40 cases were collected by Cappis in which there was affection of the nerves controlling the eye muscles. Ten cases have been reported with an associated bulbar paralysis and it is to this group that the case reported by Heuer belongs. It is assumed that the disturbance in the cerebral nerves is of a toxic nature. The palsies may appear at any stage of the disease, but they mostly manifest themselves months, or even years, after the onset. Heuer states that their presence, excluding possibly the cases with bulbar paralysis, does not contra-indicate surgical inter-

¹ *Lancet*, 1916, ii, 815.

² *Journal of Medical Research*, 1916, xxxiv, 273.

³ *American Journal of Medical Sciences*, 1916, cli, 339.

vention. Indeed, it would seem advisable to operate promptly in the hope not only of checking the progress of the palsy but also of curing the disease.

X-RAY IN EXOPHTHALMIC GOITRE. The number of reports upon this subject seem to increase each year, but, as I have remarked in the past, most of them are based upon conclusions drawn from a few cases, and others are by inexperienced men. So many methods of treatment will improve or occasionally cure a case of hyperthyroidism that it is only by a comparison of methods and of a large number of cases that we are able to draw deductions as to result. Pfahler and Zulick¹ give us a very complete review of the literature, with an extensive bibliography, and conclude that in all cases a trial treatment should be given with a view to avoiding operation in many cases. They make the important observation that treatment must not be prolonged over too great a period or hypothyroidism may be produced. They believe that at no time should the treatment be carried to the extent of producing redness in the skin. Each dose should be carefully recorded and filtered, and at no time should more than 20x, or double tint B of the Sabaouroux pastilles be exceeded in any particular area of skin. Generally speaking, with a Coolidge tube, transformer, a parallel spark gap of nine inches, and the target of the tube eight inches from the skin it will be found that 5 milliamperes of current given for five minutes and passed through three inches of aluminum and one layer of solid leather will give 18 to 20x, or approximately double tint B, and this is the dose they generally give.

Fischer² has treated, with Röntgen exposures, 94 exophthalmic goitre patients in which 20 per cent. were unable to be out of bed except as they came for treatment. A complete subsidence of all objective and subjective signs and symptoms was realized in 15 cases, and positive benefit was obtained in from 72 to 80 per cent. of all the cases. The exophthalmos was the most refractory symptom, yielding most slowly, if at all, to treatment.

Case,³ in a discussion, states that there is no literature on the subject of the Röntgen treatment of hyperthyroidism which applies in the present-day sense of *x-ray* therapy. He believes that if *x-ray* treatment is properly carried out, and he has treated about 30 cases, the results are as good as can be obtained by surgery. He divides the skin of the neck into six to ten areas, covers the neck with lead, and only treats one area at a time, filtering the rays. In this way the *x-ray* is multiplied twenty or thirty times, and if this is multiplied by the number of areas treated we would have about two hundred or more times of *x-ray* treatment given to the goitre itself than can be accomplished by the vertical *x-ray* to which most of the available literature refers.

¹ Pennsylvania Medical Journal, 1916, xix, 661.

² Ugeskrift for Læger, 1916; abstracted in Journal of American Medical Association, lxxvii, 1706.

³ Iowa State Medical Journal, 1916, vi, 201.

Ruggles¹ is also enthusiastic about Röntgen therapy, and states that he has had 24 cases, of which 10 pursued treatment for from three months to eleven months. "Without any exception they are improved as regards nervousness, sweating, sleeplessness, and weight." His technic consists of an exposure of from one-fourth to one-third of 4 mm. of erythema to hard rays through an aluminum filter.

Seymour² states that at the Massachusetts General Hospital, 80 cases have been given at least two treatments, the average being four. All have shown improvement with the exception of 7, 8 being absolutely cured of their symptoms. He states that all writers on the subject of *x*-ray treatment of hyperthyroidism have come to the following conclusions: The pulse-rate is nearly always reduced, and this, almost always at once. The tremor and nervous symptoms improve from the start. The gland rapidly diminishes in size in some cases, remains unaffected in others, but, if hard, tense, and throbbing, the throbbing diminishes and the gland becomes softer. The body weight practically always immediately increases.

Seymour urges that the *x*-ray treatment of Graves's disease should not be undertaken except by those thoroughly experienced in Röntgen therapy. His technic is as follows:

"The neck has been divided into three areas: right, left, and middle or suprasternal, and the treatment directed to these areas. A Coolidge tube has been used. The average dosage has amounted to about 4 H., which equals 5 Holzkecht or 10x Kienbock or 1B Sabouraud-Noire. This is the dose necessary to produce a slight erythema. Some writers state that an erythema dose is too severe, but we have not found this to be so. It seems advisable, however, to keep just below the erythema dose so as not to cause any skin irritation, inasmuch as it seems evident that repeated erythema may cause vessel changes in the skin covering the tumor, or the tumor itself.

"In all cases the target of the tube was at a distance of ten inches from the skin and a filter of 4 mm. of aluminum and one thickness of sole leather was interposed. The dose has not been repeated inside of three or four weeks."

THE MAMMARY GLAND.

Tuberculosis of the Breast. I seem to have missed a previous article by Durante,³ because recently, in association with MacCarty,⁴ he has published a second paper. In the Mayo Clinic from 1904 to 1915 there have been 10 cases (0.51 per cent.) of mammary tuberculosis in a series of 1933 pathological mammary conditions. Deaver found 0.8 per cent.,

¹ California Journal of Medicine, 1916, xiv, 289.

² Boston Medical and Surgical Journal, 1916, clxxv, 568.

³ Policlin., 1914, xxi, 319.

⁴ Annals of Surgery, 1916, lxiii, 668.

Scott 1.4 per cent., and Bloodgood 0.6 per cent. of their mammary specimens tuberculous. In the 10 cases observed by the writers from the Mayo Clinic, there were 3 associated with tuberculosis of the lungs, and 3 cases associated with no other clinical tuberculous lesion other than tuberculosis of the axillary lymphatic gland, and 1 which was associated with a pleurocostal lesion.

Gatewood¹ reports 5 cases observed in the Presbyterian Hospital, Chicago, in the past ten years, representing 1.04 per cent. of all breast cases in which operation was performed during that period. In 1881 Dubar classified tuberculosis of the breast into two types, the nodular or discrete, and the confluent. The nodular type has been subdivided into the solitary and the disseminated forms. All of the cases reported by Gatewood belonged to the confluent type; 2 of them undoubtedly were secondary; while the other was probably deuteropathic, although no primary focus could be found. Gatewood questions the accuracy of the cases reported wherein 60 per cent. are reported as primary. He states that absolute proof of a singular case of primary tuberculosis arising in the mammary gland is still lacking. He does not discuss treatment, but the cases seem to have been treated individually rather than on any set principle.

Chronic Cystic Mastitis. All of the studies coming from the Mayo Clinic are based upon such large numbers of cases as to make them almost authoritative. We have previously referred to a paper by MacCarty upon this subject, and this year MacCarty and Mensing² have published a paper in which 406 cases of simple chronic mastitis are studied, and compared with 967 cases of mammary cancer. They believe that there certainly is an association of chronic mastitis with carcinoma, but they cannot state that chronic mastitis is an etiological factor in breast cancer. The association of the two conditions is too close to allow the consideration of one without the consideration of the other, because, in studying the microscopic pictures, they found the line of demarcation between the acinus and the stroma sometimes so confused as to make it impossible to accurately state whether one is dealing with cancer or not. The following represents the clinical differences between the two groups of cases: In chronic simple mastitis the average age was 40 years; a discharge from the nipple was present in 6.6 per cent.; trauma was a possible etiological factor in 4.4 per cent.; and 22 per cent. were unmarried. In cancer the average age was 47.9 years; a discharge from the nipple was present in 8.4 per cent.; trauma was present in 8.6 per cent.; and 13 per cent. of the patients were unmarried. The accuracy of diagnosis is also considered by MacCarty and Mensing as expressed in figures. Of all cases of chronic mastitis, 62.7 per cent. were not diagnosed correctly by the clinicians; whereas in cancer the

¹ Journal of American Medical Association, 1916, lxxvii, 1660.

² St. Paul Medical Journal, 1916, xviii, 164.

diagnosis was wrong in 23.9 per cent. The percentage of legitimate error in the clinical diagnosis of the condition of the axillary gland was 36.9 per cent.

In regard to treatment, they practically repeat the statements in their previous paper, and which have been given in *PROGRESSIVE MEDICINE* for March, 1914.

Another interesting paper which has recently appeared is that by Syms.¹ His paper is very complete, but we will pass on to the portion devoted to treatment. He calls attention to the contradictory state of surgical opinion regarding the extent of operation. He believes that we should regard chronic cystic mastitis as a precancerous condition, that each case should be considered as a potential cancer; in other words, we should perform a radical ablation of the breast because simple amputation is not so effective. While it is true that some breasts will be sacrificed that might have been preserved, and that sometimes an unnecessary major operation will have been performed, it will result in the greatest ultimate conservation and we may have 100 per cent. of success as far as cancer is concerned. The ever-increasing knowledge on the part of the general practitioners, and the instruction that is being given to the public through the Organized Cancer Campaign, will bring about a new state of affairs, and surgeons will begin to see these cases during their early periods.

In the discussion of this paper² practically all of the members of the New York Surgical Society who spoke were opposed to the radical stand taken by Syms. It will also be remembered that in Greenough's series only 4 cases out of 88 who had had a partial operation for chronic cystic mastitis developed cancer later, and that in none of the seventeen reported from my clinic by Müller did cancer develop.

Another paper on this subject has been published by Barrie³ under the title of "Regressive Changes in the Breast." There were 38 benign breast lesions, of which 18 were examples of chronic cystic mastitis, and 5 others, non-encapsulated papillary cystadenoma, are added to the group. Both Barrie and Syms, in their papers, are not enthusiastic about basing the extent of the operative treatment upon the frozen section.

Cysts of the Breast. Sheppard⁴ reports 4 cases and states that for a number of years in any doubtful case he puts a needle into the mass, and, if it is cystic, the fluid is evacuated and the tumor disappears. If it is a solid growth the needle assists in the diagnosis. If the fluid was clear, he had no doubt of its non-malignancy, but, if it was bloody, the case was operated on. This method of treating cysts of the breast was first brought to our attention by Abbe⁵ in 1903. In the discussion on Syms's

¹ *Annals of Surgery*, 1916, lxiv, 696.

³ *Ibid.*, 707.

⁵ *Medical Record*, August 15, 1903.

² *Ibid.*, p. 739.

⁴ *Ibid.*, p. 254.

paper mentioned above, Schley and Meyer refer to this method. Moschovitz stated that extirpation should always be done if any sense of thickening remains after aspiration, or if there should be coincident nipple discharge. Abbe would not countenance tapping of a cyst if he had to deal with a patient in the real cancer age, say about thirty-five.

Halstead¹ reports a *new sign* useful in the diagnosis of retromammary cysts and possibly in solid tumors as well. If, when palpating the breast, the suspected tumor should suddenly slip outward under the fingers, its diagnosis will be established.

Cancer of the Breast. There seem to be but three papers devoted to this subject and a couple of others treating of certain details. Bloodgood² publishes another one of his interesting and instructive statistical papers in which it is shown that education can increase the number of cures. In comparing the benign with the malignant lesions he found that in about six years, as compared with the previous ten years, the percentage had increased from 41 to 54. Inoperable cases of cancer are distinctly on the decrease. Adenocarcinoma, with areas of fully developed cancer, is distinctly on the increase, and he is inclined to feel that this is also an indication of an early cancerous tumor. The fully developed cancers, of the scirrhus, medullary, and cancer-cyst type, are on the decrease. It is curious that Bloodgood, in almost the same words as Syms, states that if women came early we shall find that the border-line group is larger, and that the difficulties of the surgeon will increase. No well-trained surgeon will at the present time fail to recognize the fully developed cancer or the distinctly benign encapsulated tumor, but the errors will be made in the border-line cases and perhaps 10 or 20 per cent. of the benign lesions will be submitted to the radical operation until we have developed a method of more exact diagnosis. Bloodgood believes that when women understand the situation, they will prefer the slightly mutilating operation to the danger of an incomplete removal of a malignant tumor.

The early diagnosis of cancer of the breast is considered by Peck.³ He quotes from all the well-known writers on the subject and believes that the clinical signs and history must form our basis for a diagnosis of malignancy of the breast. Section through, or into, the tissue of a tumor of the breast is never justifiable for the purpose of diagnosis. He believes that gross examination of the fresh specimen by a well-qualified pathologist at the time of operation is safer than the examination of frozen sections alone. He quotes the following symptoms from Taylor⁴ who believes that one or another of them represent the first signs of a carcinoma of the breast in 95 per cent. of cases: (1) Growth in the breast; (2) growth and

¹ Bulletin of Johns Hopkins Hospital, 1915, xxvi, 350.

² Journal of American Medical Association, 1916, lxvi, 552.

³ American Journal of Surgery, 1916, xxx, 188.

⁴ Cancer, 1915, p. 117.

pain; (3) pain alone; (4) retraction of the nipple; (5) growth in the axilla.

RADICAL AMPUTATION UNDER LOCAL ANESTHESIA. An interesting case is reported by Cole¹ in which he removed the breast and dissected the axilla under local anesthesia after the method of Braun. The brachial plexus was first injected with 10 c.c. of a 2 per cent. novocain-adrenalin solution. The first eight dorsal nerves were then injected with 5 cm. of a 1 per cent. solution, and, finally, the supraclavicular branches and the overlapping innervation from the opposite chest were infiltrated with an 0.5 per cent. solution. The patient was a nephritic and the operation lasted nearly two hours, but the patient experienced no pain or shock.

TREATMENT OF INOPERABLE CANCER OF THE BREAST. The inoperable cases are a source of embarrassment and trial to all surgeons and any method which makes them comfortable until the end is worthy of note. Strobel² describes a method used by him in 16 cases since 1898. He destroys the skin, the fascia and the breast with caustics, then skin grafts the granulating wound, and treats the chest with radium and *x*-rays. It seems to me that the early treatment must be a severe one and frequently accompanied by extensive suppuration and exhaustion incident thereto. We have usually obtained relief from pain by the *x*-rays or by radium, and have occasionally removed the breast under nitrous oxide anesthesia with the actual cautery. I fail to see any advantage of the slow and painful zinc chloride and potassium hydroxide used by Strobel over the clean, hot iron.

¹ Surgery, Gynecology and Obstetrics, 1916, xxii, 246

² Medical Record, 1916, xc, 271.

SURGERY OF THE THORAX, EXCLUDING DISEASES OF THE BREAST.

By GEORGE P. MÜLLER, M.D.

Injuries of the Heart. In preceding numbers of PROGRESSIVE MEDICINE, and up to 1913, an attempt was made to keep track of all wounds of the heart reported in the literature. Since then only a brief mention has been made of these injuries, and the most important articles summarized.

An interesting account of a gunshot wound of the heart, which recovered without operation, is given by Woollatt.¹ After the receipt of the injury, the patient developed pallor, rapid pulse and urgent dyspnea; a probe, which had been passed into the wound, was "gripped" by the heart and moved with its beat. The probe was withdrawn and a brisk hemorrhage followed, but soon ceased. Improvement followed, and on the third day a pericardial rub was audible, which lasted for fifteen days. The patient made an uneventful recovery.

STAB WOUND OF THE PERICARDIUM. Fuller² reports the following: The patient received a stab wound which severed the sixth cartilage, opened the pleural cavity, collapsed the lung, and cut the pericardial sac open for a distance of about two inches. He became much shocked, and, when moved about or turned, streams of blood would spurt from the chest wound. Operation was done at once, and a part of the sixth rib resected and removed. The chest cavity was found to contain many large clots and much free blood, and the heart could be seen and felt beating feebly and irregularly, the pericardial cut could be seen and the cavity was filled with blood clots. By retraction of the fifth and seventh ribs a good view was obtained, and the pericardial sac was mopped free of blood clots and tightly closed. The pleural cavity was cleansed of blood clots and sponged out with salt solution. The opening in the thorax was then tightly closed by first approximating, as closely as possible, the parietal pleura, then the intercostal soft parts, and finally the skin. No drainage at any point was used. Under proper post-operative treatment the patient recovered.

Fuller states that in this case the collapsed lung was of distinct value, and he believes that the use of any differential apparatus is time-consuming in such cases. He also believes that pleural and pericardial drainage in stab wounds is contrary to modern surgical principles.

¹ Lancet, 1916, i, 1261.

² Surgery, Gynecology and Obstetrics, 1916, p. 747.

WAR INJURIES. Probably nearly all cardiac wounds produce death from hemorrhage too quickly to allow of the patients being removed alive even to a short distance from the battlefield. The following reports are those of more than ordinary interest, giving us a picture of the late cases, and perhaps of value in civil as well as military practice.

CASE I.—Reported by Dixon and McEwan.¹ The patient was admitted to the hospital nineteen hours after having been hit by a rifle grenade. He was in a state of shock, suffering from dyspnea, and thirst, but no pain and no cough. The heart sounds were normal. There were signs of fluid in both pleural cavities. He died fifty-nine and a half hours after receiving the injury. At autopsy it was ascertained that the cause of death was severe hemorrhage complicated with pulmonary collapse and interference with the heart's action. The enormous amount of blood in the pleural sacs came from the heart; the lung wounds were not capable of causing much hemorrhage. With each systole some blood would be forced through the small openings in the right ventricle into the pericardial sac, and from there would ooze through the pericardial openings into the pleuræ. The pericardium presented the appearance of early pericarditis, suggesting the beginning of an infective process.

CASE II.—Reported by Skirving.² The patient was wounded somewhere in France, on October 11, 1915. He was hit under the left axilla about the posterior axillary line. The missile travelled obliquely through his lung, and there was no wound of exit. He suffered much from shock, remained practically unconscious for three days, and probably had pericarditis for a week. He was later sent back to his regiment, but became unfit for duty because of shortness of breath on exertion and because of pain in the chest. He was seen by Skirving on February 7, 1916. The only signs of importance at this time were a swift, blowing, mitral systolic murmur, a marked reduplication of the second sound, especially in the pulmonic area. X-ray examination showed a foreign body moving with the heart laterally, and vertically with the respiratory movement, and believed to be imbedded in the sac and lying upon, or between, the pulmonary veins. Operation was performed on March 21, 1916, under endotracheal ether anesthesia. Skirving first incised at the level of the sixth costal cartilage and exposed this structure and removed it. The triangularis sterni muscle was divided and the internal mammary vessels ligated and divided. The pleura was pushed upward and outward. Further access was then gained by making a vertical incision to the level of the second, and the third cut made outward from the upper end of this. The entire cartilage, muscle, and skin were lifted up, and the underlying pleura stripped of its inner surface as far back as was necessary. The pericardium was then opened and the

¹ British Medical Journal, 1916, i, 755.

² British Journal of Surgery, 1916, iv, 96.

cavity found to be occupied by several sticky, blood-stained adhesions; they were swept asunder with the finger, and the metal mass found in the posterior wall of the pericardium. It was removed, the pericardium was sutured with catgut, and the flap allowed to fall back into place and also sutured with catgut. No drainage was used. Skirving believes that the chest pain may be relieved, but that the adhesions may reform and cause some permanent hobbling of the heart.

CASE III.—Reported by Jones.¹ The patient was wounded on October 1, 1915, and suffered two shell wounds of the chest wall, one in the fourth intercostal space and the other in the seventh space. He was admitted to the hospital on October 3, expectorating blood, suffering from dyspnea, and unable to sleep. He complained of a stretching pain at the back of the left chest, but there was no edema. His pulse rate had averaged seventy, and his temperature was normal, and *x*-ray examination revealed an extensive pericardial effusion. Operation was then performed under ether anesthesia. Portions of the seventh, sixth, and fifth intercostal cartilages and half the width of the sternum were removed. The pericardium was well exposed, and was incised vertically for two inches. The heart at once plugged the wound. On pushing that organ backward, a large quantity of foul-smelling gas and fluid was evacuated; the latter was blood-stained and measured 22 ounces. The pathological report on it showed *B. perfringens*, enterococci and also a few staphylococci. Fresh adhesions were broken down, the pericardial cavity mopped out, and a rubber drain introduced. The chest wall was then sutured together. Subsequently, irrigations were practised, and it was found that saline solution caused great pain, always referred to the middle of the back, whereas a weak iodine solution was well borne. Pushing the heart out of the way caused no sensation or distress, and he was unconscious of the movement. He made a good recovery, and on January 16, 1916, had no symptoms referable to the heart.

CASE IV.—Reported by Lower,² from the American Ambulance at Neuilly-Sur-Seine. The patient was hit by a rifle ball which entered about 4 cm. to the left of the first dorsal vertebra. He suffered little or no pain and was sent to the Base Hospital. An *x*-ray picture showed the bullet in the same shadow as the heart, and fluoroscopic examination disclosed that every time the heart beat the bullet moved with it. He complained of fatigue and shortness of breath when walking or exercising. Operation was done about three and a half months after the infliction of the injury. The operation was performed under nitrous oxide-oxygen anesthesia, and incisions were made as shown in Fig. 1. The bullet was found with its point having just passed through the pericardium, and was easily removed. During the operation the pleura

¹ British Journal of Surgery, 1916, iv, 103.

² Annals of Surgery, 1916, lxi, 533.

was opened and there was collapse of the lung, but little disturbance resulted from this. The wound was closed with a small cigarette drain. The patient developed pneumonia two days later, but finally recovered.

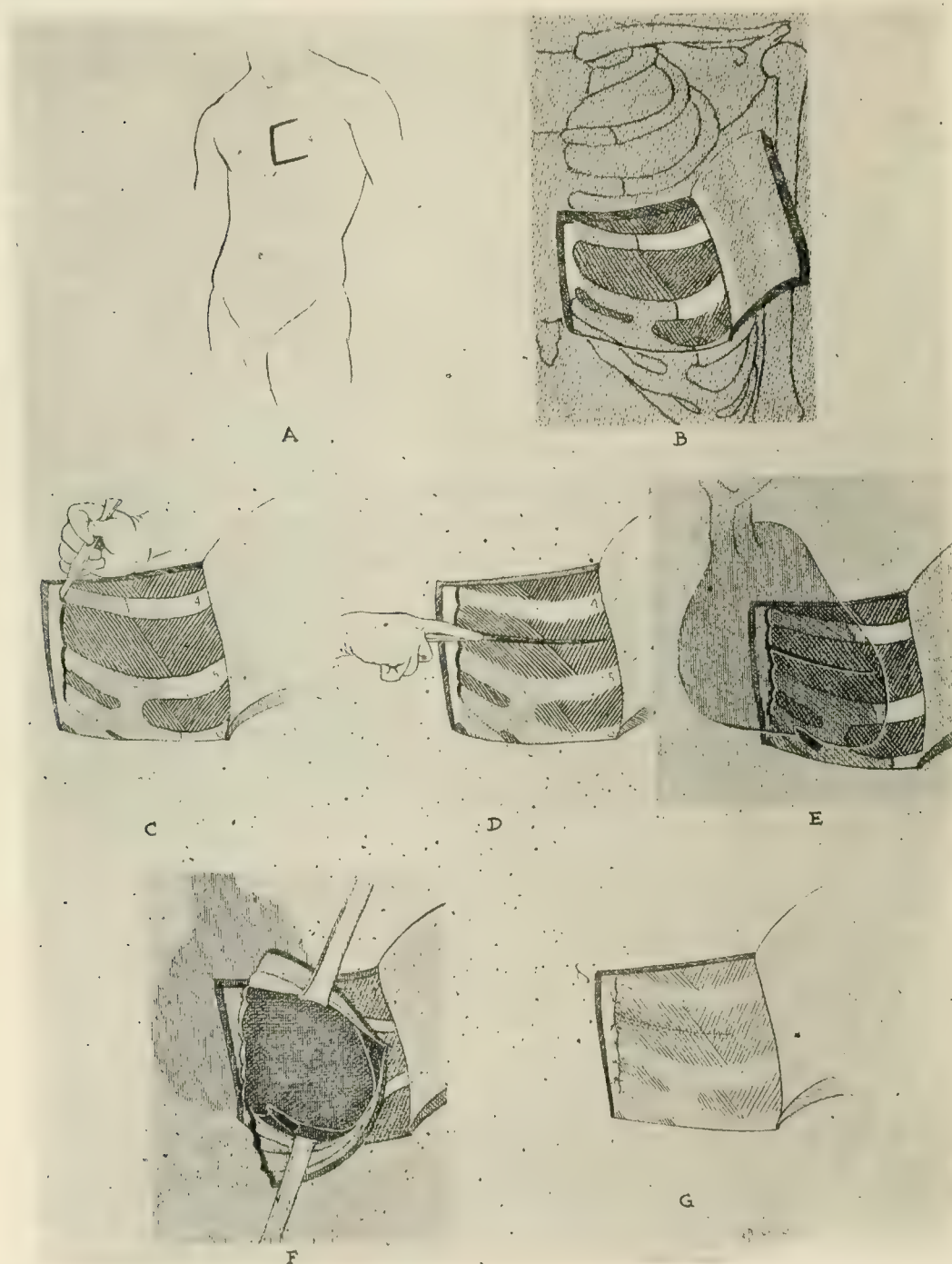


FIG. 5.—Schematic drawings illustrating various steps in the operation for the removal of bullet from pericardium.

CASE V.—Conteaud and Bellot¹ report the case of a man shot in the chest and who suffered from retrosternal pain and fever. Six months later, radiosopic examination disclosed a bullet embedded in the right

¹ Rev. de Chir., 1915, xxxiv, 433.

segment of the cardiac mass. Operation was not attempted for two months later, at which time the two layers of the pericardium were found totally adherent, with no free space. The bullet was found embedded just above the outlet of the inferior vena cava. Death occurred two days later.

CASE VI.—Birkbeck, Lorimer and Gray¹ observed a patient hit by a bullet eight days previously. The patient showed no particular symptoms during the first few days, but later, owing to pulse irregularity and dropped heart beats, an operation was decided upon. This was done under local anesthesia (eucaine 1 per cent., potassium sulphate 0.25 per cent., and adrenalin). The bullet was probably almost in the right ventricular cavity, as it was removed therefrom after some manipulation. Drainage was not used. The patient died four and a half days after operation.

In addition to the above, Leslie² quotes Murphy³ as having stated that he has seen 4 cases in which, from the line taken by the bullet, it would appear that the heart must have been perforated in several places, and yet, apart from the slowness of the pulse, there was no disturbance of heart action, and in only one was there pericardial friction. Leslie quotes Eccles as having observed a patient who had walked a mile and a half after having been struck by a bullet, and in which the *x*-rays showed the bullet situated in the heart and moving synchronously with the contractions of the heart.

Other interesting reports by Ascoli and Masserini,⁴ Bichät,⁵ Villeon,⁶ and Silvan,⁷ have been published.

Suppurative Pericarditis. One of the border-line diseases sometimes treated by the physician and sometimes by the surgeon is pericarditis with effusion. Aspiration may be done by either, but, when drainage is necessary, the case becomes purely surgical. For this reason a *résumé* of two articles on this subject properly belongs in this discussion. Locke,⁸ writes on the occurrence and diagnosis of pericarditis. Except in the case of injury, pericarditis is never primary, but occurs as a complication, often terminal, during the course of some other disease. For this reason it is often overlooked and only detected at autopsy. Locke describes in great detail the various causes, and the clinical picture of pericarditis.

The percentage of cases of pericarditis which become suppurative seems to vary according to different observers. One series shows 1.6

¹ British Medical Journal, 1915, ii, 561.

² New York Medical Journal, 1916, civ, 625.

³ Wounds of the Thorax in War, 1915.

⁴ Clinical Chirurgie, 1916, xxiv, 377.

⁵ Bull. et Mém. Soc. de Chir. de Paris, 1916, xlii, 1100.

⁶ Ibid., 998.

⁷ Riforma Med., 1916, xxxii, 297.

⁸ Boston Medical and Surgical Journal, 1916, clxxv, 590.

per cent., and another 7.4 per cent. Suppurative pericarditis is also discussed by Rhodes.¹

"A small amount of pus in the pericardium can give no symptoms, aside from its constitutional evidences and the increased leukocyte count, and can be diagnosed with certainty only by the *x*-rays. This constitutes the first stage of the lesion, and one, unfortunately, very seldom diagnosed. A second stage is instituted with the increase of the exudate up to the limits of elasticity of the sac. This stage is the ordinarily observed stage of physical signs. When, however, the limit of elasticity of the sac is overstepped by the amount of exudate, a third stage is seen, to which Rehn has given the name of Herzdruck. Rose calls it Herztamponade."

Among the symptoms mentioned we find, in the suppurative type, a high leukocyte count, more pain, the frequent presence of edema of the upper thorax, and the greater value of the *x*-rays.

TREATMENT. Locke believes that, considering the relative frequency of pericarditis and its favorable course, paracentesis is rarely necessary except in the occasional case when a purulent exudate is suspected. On the other hand, Rhodes believes that aspiration of the pericardium in suppurative pericarditis, for treatment or diagnosis, must be most emphatically condemned. He believes that if due attention be paid to the *x*-ray, leukocytosis, and temperature chart, the diagnosis should be made. In discussing the best site for aspiration, Locke mentions favorably the fifth or sixth interspace, 2 or 3 cm. outside the nipple line, and inside the outer limits of dulness. The method of Marfan is favorably mentioned. It will be remembered that in this method the needle is directed upward from beneath the xiphoid. Rhodes objects to the methods of aspiration in suppurative pericarditis because of the danger of penetrating the pleura and infecting it, because adhesions binding the heart to the anterior chest wall may expose this organ to puncture, and because, as the beginning exudate is found in the accessory sinuses, the pus may not be reached by the needle. Rhodes refers to the treatment of pericarditis, but does not go into any detail. He states that the exudate should not be allowed to escape too rapidly from the pericardium, and that free drainage must be maintained. He prefers the method whereby the pericardial sac is stitched to the skin. To the 73 cases reported by Eliot in 1909, Rhodes adds 13, giving a final list of 86 cases, of which 45 recovered and 41 died.

Injuries of the Chest during War. A great number of papers have appeared during the past year bearing upon the treatment of thoracic injuries, the results of gunshot and shrapnel wounds. It is impossible at this time to analyze the results and to decide upon the best line of treatment. Probably next year we shall be in a better position to do so.

¹ *Annals of Surgery*, 1915, lxii, 660.

The following description is taken from the writings of Rudolph,¹ Bradford,² White,³ Menzes,⁴ Leslie,⁵ Davies,⁶ and Howard.⁷

They classify these gunshot wounds into penetrating and non-penetrating, according to whether the chest wall only, or the thoracic cavity with its contents, has been pierced by the missile.

A. NON-PENETRATING WOUNDS OF THE CHEST. Shrapnel bullets often lodge in the chest without penetration, and produce jagged, painful wounds which are invariably septic. Glancing flesh wounds are also quite common.

Burckhardt and Landois⁸ have observed a large number of these tangential wounds of the thorax. The ribs were usually fractured, sometimes the pleura was uninjured, while in other cases the pleura was pierced and the lung grazed. There is great danger of infection in these wounds because of the splintering of ribs, the oblique insertion of the muscles and other soft parts and the frequency of an open pneumothorax.

Leslie notes that sometimes the lung may be contused without actual penetration of its tissue, the blow on the bony wall of the thorax producing the bruising of the lung. Hemoptysis, therefore, is not a conclusive sign of lung penetration.

B. PENETRATING WOUNDS OF THE CHEST. Wounds in the long axis of the body are more dangerous than the transverse, owing to the tendency to cervical and abdominal complications. Wounds in the middle of the chest are extremely dangerous, owing to the presence of the heart and pericardium, the great vessels, and the large bronchi.

White reports a number of unusual cases of bullet wounds of the chest as showing that bullets may, even when it seems almost impossible, considering their track, avoid damage to nerves and vessels; and even when they pass right through the lungs the harm to the lungs may be slight.

He states that hemoptysis is very common, and while it doubtless does sometimes immediately kill, if it does not kill soon, it rarely, if ever, does later. Hemothorax is frequently seen. The unusual signs of fluid in the chest and pyrexia are present, and the latter symptom has often led to an erroneous diagnosis of pus.

Penetrating wounds may give rise to: (1) Hemothorax; (2) pneumothorax; (3) pyothorax; (4) simple serofibrinous pleurisy; (5) laceration of the lung.

Hemothorax is so common as to constitute the distinctive clinical feature of penetrating wounds of the chest. It occurs in 75 per cent. of such cases. The bleeding may come from the lung or from the chest wall.

¹ Quarterly Journal of Medicine, 1916, ix, 257.

² Lancet, 1916, i, 227.

³ Ibid., 1915, ii, 1233.

⁴ British Journal of Surgery, 1916, iii, 667.

⁵ New York Medical Journal, 1916, civ, 628.

⁶ Lancet, 1916, ix, 257.

⁷ American Journal of the Medical Sciences, 1916, clii, 651.

⁸ Münch. med. Wchnschr., 1915, lxii, 1057.

In hemothorax the greatest danger is infection, and probably 25 per cent. of the cases are infected. The infection may be received from the lung, from the skin surface, or from a foreign body carried in with the missile.

Clinically, in the absence of infection, the patient complains of dyspnea, most marked during the first two or three days, and increasing if there is a fracture of the rib. There is generally mild pyrexia, and the physical signs are those of pleural effusion. There is not much displacement of the heart, and retraction of the chest sets in earlier. Above the area of dullness there is frequently skodaic resonance. Often there is tubular breathing, bronchophony, and whispering pectoriloquy in place of distant breath sounds. The usual symptoms of fluid, however, and the use of the aseptic needle makes the diagnosis an easy one. Rudolph calls attention to the condition of masive collapse of the lung, most apt to occur when there is a wound near the diaphragm, and characterized by a dull note and distant breath sounds from the affected portion of the lung. The chief distinguishing point is that in collapse the neighboring organs are drawn *toward* the dull area. All writers emphasize the importance of the x-rays, and Rudolph notes the necessity of making the examination with the patient in the vertical position.

In septic hemothorax, the symptoms are much more pronounced, and the patient is obviously ill, with high temperature, rapid pulse, and increasing dyspnea.

In discussing the physical signs, Bradford states that there is an absence of well-marked physical signs during the first twenty-four hours. Cough, dyspnea, anxiety, etc., are much better marked. But twenty-four hours later the same patient will present typical and obvious signs of a large hemothorax. He notes several differences from the signs of an ordinary pleural effusion. The diaphragm on the affected side is extraordinarily high and often the cracked note merges into the skodaic resonance of the upper part of the front of the chest. Owing to this, a hemothorax may be overlooked or diagnosed as a pneumothorax. In the second place, the skodaic phenomena are much more marked than in the ordinary pleural effusion. In the third place, loud tubular breathing, increased bronchophony and pectoriloquy are more marked than in pleural effusion. Finally, the apex tends to be displaced early, but later may return toward its normal position by, say, one inch. He believes this is either due to the absorption of the air or else the occurrence of collapse of the lung allows the heart to return to its normal position. He inclines to the latter view. If the effusion of blood is not aspirated soon, the affected side may show a retraction in two or three weeks. Bradford also discussed the physical signs in certain atypical cases, which it is not necessary to repeat here.

Davies gives some additional facts regarding these injuries. He states that the hemothorax may be complicated by effusion or by sepsis. Serous effusions develop mostly as a complication of hemothorax in which the blood is clotted and infected. Infection of a fluid hemothorax

is, as a general rule, easy to diagnose; but the recognition of infection of a large clot, especially accompanied by a serous effusion, may be difficult. In many of these cases the source of infection is particles of clothing, and these form the center of the coagulum. Davies lays stress upon the persistence of shortness of breath upon exertion after the patient has apparently recovered entirely. He believes that this symptom is not necessarily due to an associated fibrosis of the lung, nor is it necessarily due to the restriction of lung area, but rather is in the nature of a reflex condition dependent on the existence of an adverse ratio of the capacity of the expansion of the chest wall and for expansion of the lung.

Pneumothorax without hemothorax seems rare. Rudolph notes that the coin sound is very elusive. In many cases it is not present at all, although the diagnosis of pneumothorax is confirmed by the *x*-rays. The percussion note is usually hyper-resonant and when the air is under pressure it may be almost dull. Breath sounds are distinct and vesicular unless there is a large opening, in which cases the type of breath may be amphoric and often very loud. Vocal fremitus and resonance are usually about normal, and tinkling rales are sometimes heard.

The symptoms and physical signs resulting from wounds of the chest are described statistically by Howard,¹ from cases seen in No. 3, Canadian General Hospital. One hundred and seven (or 6 per cent.) of their cases received either a gunshot wound or a shell wound of the thorax. The patients were admitted during the period from August 7 to November 1, 1915. Twenty cases were evacuated too rapidly to permit of a physical examination of the chest. The remaining 87 were divided into four groups.

Group 1. Fifteen of the patients presented no projectiles in the lung or pleura at the time of examination. Seven of the wounds had penetrated the chest, and the remainder had only entered the parietal wall.

Group 2. Consisted of 6 cases, comprising 4 of pneumonia and 2 of simple effusions.

Group 3. One case of mediastinitis, resulting from a rifle bullet lodging in the anterior mediastinum. This patient complained of pain referred to the right side of the neck and a slight dysphagia. There was a definite area of dullness corresponding to the anterior mediastinum and a pronounced crepitation of the manubrium, a well-marked friction sound was heard. The bullet was seen in the skiagram.

Group 4. This group comprised the hemothorax cases, 65 in number, of which 9 were definitely infected. All of the physical signs are described in this paper with statistics as to their frequency in the cases reported.

Of the 87 cases, 6 died, and of these, 4 were infected.

Pyothorax. In large measure a pyohemothorax. This condition should be properly recognized and properly operated upon by rib resection and free drainage.

Serofibrinous Pleurisy. Serofibrinous pleurisy, with clear serous

¹ American Journal of the Medical Sciences, 1916, clii, 651.

effusion, is rare, although White has described a case. In such cases the blood acts as an inflammatory agent.

In speaking of *wounds of the lung*, Rudolph has seen no case in which hemoptysis is absent, but there may be no other symptoms, even though the bullet has passed clean through the lung. In most cases, however, there is more or less bleeding into the pleura, and often pneumothorax. In other cases the passage of the bullet through the lung sets up hemorrhage into the lung tissue, and this produces a massive consolidation; more rarely, a true pneumonia may follow the local lesion. If there is much laceration of the lung by the bullet, an abscess may accrue later.

TREATMENT. In the treatment of sterile or mildly infected cases of hemothorax, Rudolph believes that if the amount of blood be small, the case may well be left to nature. If they are passed from one hospital to another, they should travel as "stretcher cases" and be kept very quiet. When the chest is filled with blood, and when there is displacement of the heart, he states that the fluid should be removed, either by aspiration at one sitting, by several small aspirations, or by the removal of the fluid and at the same time replacing it with a gas. He prefers the latter method. A large-sized aspirating needle is introduced into the eighth interspace near the posterior axillary line and the fluid siphoned off. A small cannula connected with an artificial pneumothorax apparatus is introduced into the third interspace and the gas introduced as soon as the blood flow begins to lag. He seems to use oxygen, nitrogen, or simply filtered air and does not attempt to put in as much gas as there was fluid in the pleura.

He notes that after the removal of the blood the heart often takes a long time to return to its normal position, and also that it is not at all uncommon to find pneumonia develop on the opposite side of the chest from the hemothorax. In a few cases the blood may coagulate in a massive way in the pleura.

In discussing treatment, Bradford states that aspiration with oxygen replacement is a much more satisfactory operation than ordinary paracentesis. One great advantage of it is that all of the fluid can be removed at once. The fluid is withdrawn, and when the patient experiences a sense of tightness, oxygen is allowed to flow in, and when the discomfort has passed, a further quantity of the fluid is withdrawn, and so on until the operation is completed. In the infected cases resection of a rib and the introduction of drainage is indicated as soon as the bacteriological evidence proves the infection. In regard to pneumothorax, Bradford states that this complication produces difficulties with regard to treatment. If aspiration is done, the apparatus should be provided with a manometer, because if the intrapleural pressure is less than that of the atmosphere, aspiration could do no good.

White notices that in many cases it is unnecessary to aspirate the blood, but the physical signs return to normal much more slowly than with an ordinary pyretic effusion. He notes that in one case there was

more reason to suspect that a too rapid emptying of the chest led to a pneumothorax from a tearing open of a wound in the lung. He also notes that even after aspiration of the blood, dulness remains longer than after the withdrawal of the same amount of clear fluid. It is quite certain that the displaced heart does not return at once to its normal position. Perhaps this is because the heart is held out of place by blood clots, but it is possible that a slow extension of the collapsed lung is also responsible. White suggests that we should learn from those who see these cases abroad as to how soon it is wise to withdraw the fluid.

He reports that an empyema has occurred in 10 per cent. of his cases. Only twice has hemothorax been noted, and in one of these fluid aspirated.

Davies¹ also practises "oxygen replacement," which was described by him in 1912.

Clots of uninfected blood must be removed through an opening made in the chest wall. He performs a subperiosteal resection of a portion of the rib and through the opening removes the clot. The wound is then sutured tightly, and the air in the pleural cavity replaced by oxygen. If the hemothorax is infected, it must be drained just as in ordinary empyema.

Davies emphasizes the necessity of having a manometer connected with the pleural cavity and registering constantly the variations of intrapleural pressure, and having means of controlling the same during operative interference on the closed chest.

Menzes believes that when effusion is present the chest should be aspirated at the earliest date and cultures made. When the fluid is found to be sterile, it should always be removed if large and producing marked dyspnea and displacement of the mediastinum. When the hemothorax is found to be infected, it should be aspirated or drained early, and Menzes seems to prefer resection of a portion of rib and drainage by tube. When distinct pus is present, the pleural cavity should be drained at the earliest possible time by resection of a rib and the introduction of a large drainage tube.

The technic of extraction of projectiles from the lung has been discussed mostly in the French literature. Marion² is the foremost advocate of operation, and in his latest paper reported that he had operated on 43 cases. His technic is as follows:

"Having localized the projectile, an incision is made parallel to the nearest rib above or below it; the rib is resected for a length of 4 or 5 cm.; the lung is next stitched to the chest wall with a Reverdin needle and three or four threads of catgut over the area of the rectangle which forms the field of operation bounded above and below by a rib and laterally by the ends of the resected rib. The lung is then incised and the finger is pushed in, no heed being taken of bleeding or air bubbles. When the projectile is reached, it is seized with the finger, bent to form a hook, and pulled out, regardless of tearing the lung; if it cannot be

¹ *Lancet*, 1912, ii, 1774.

² *Bull. et Mém. de la Soc. de Chir.*, 1915.

caught with the finger, the parenchyma is drawn out with Kocher's forceps while the projectile is pushed out with the index finger; when brought to the chest wall it is removed with the help of a grooved director or a bistoury. Finally, the wound in the lung is plugged with a compress soaked in strong carbolic solution and an ordinary dressing is applied to the one in the chest wall."

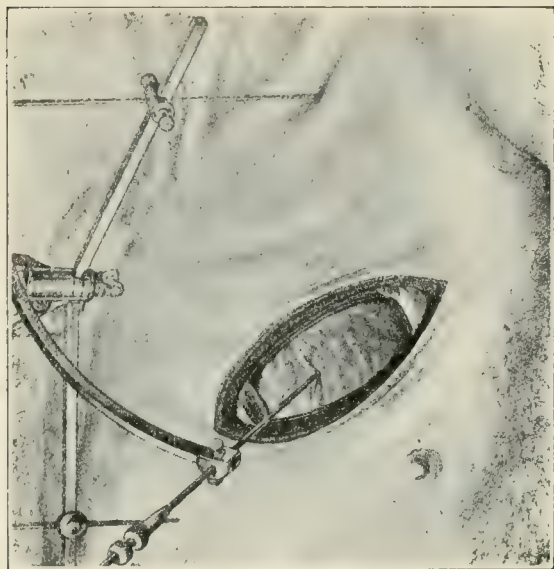


FIG. 6

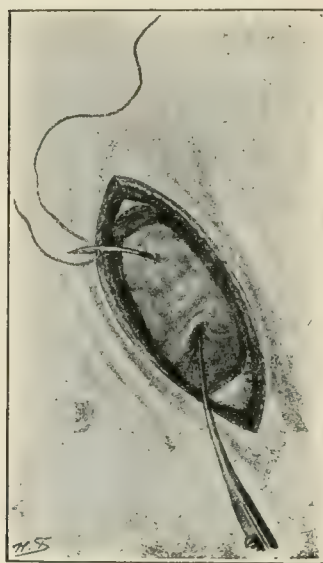


FIG. 7



FIG. 8

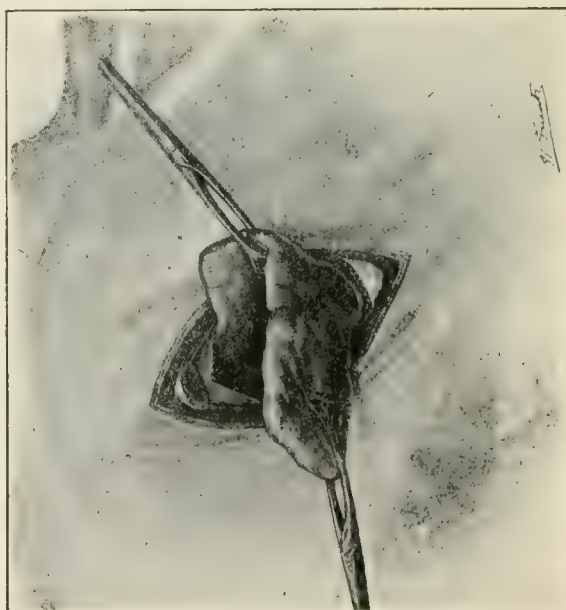


FIG. 9

He has had no serious bleeding and only temporary hemoptysis. Duval¹ objects to Marion's method of pushing the finger into the lung and also to the tamponing of the lung. He opens up the pleura widely, disregarding the pneumothorax, grasps the lung with forceps and pulls it out of the wound, just as a loop of intestine is pulled out during an

¹ *Revue de Chirurgie*, Paris, 1916, li, 365.

abdominal operation. The lung can then be palpated, the foreign body extracted, and the lung sutured. The pneumothorax is relieved by aspiration at the conclusion of the operation (Figs. 6, 7, 8, 9 and 10).

Maucclair¹ locates the foreign body by *x*-rays, incises over a rib and resects it. The lung is then sutured to the wound, incised, and the foreign body removed under the radioscopic screen. The lung wound is not sutured. Villeon² operates by a similar technic. The anesthetized patient is placed under the screen and the projectile located. Two or three finger-breadths away an incision is made in an intercostal space and only 5 mm. long. Through this a long forceps is introduced and bored into the lung in the direction of the foreign body, which is grasped and withdrawn. The direction is controlled by the screen. This technic has been used in 16 cases, withdrawing 17 projectiles. There are practically no sequelæ, slight hemoptysis being the only one.

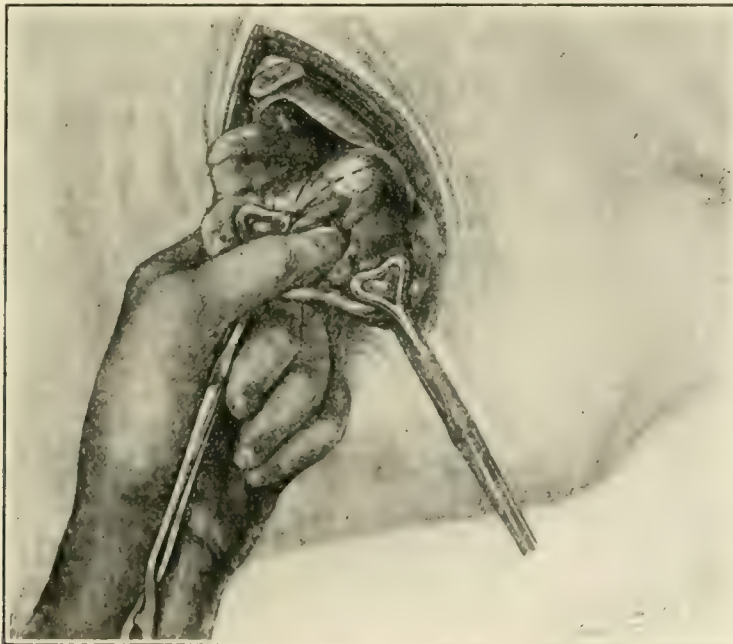


FIG. 10

FIGS. 6 to 10.—The bullet is located by means of the *x*-rays and Hirtz compass. The compass is kept in place until marked by a silk ligature in the pleura. When the pleura is opened, collapse of the lung occurs, causing great shrinkage in size, and this enables easy palpation of the bullet, delivery of the lung into the wound, incision and removal of the bullet.

Piery³ is not as optimistic as is Marion, and he only removes pulmonary projectiles when there are certain indications. He, just as others do, believes that they are often well-tolerated. Pulmonary abscess and persistent hemoptysis furnish indications for pneumotomy. Piery notes that in all these cases there is a pneumonia and a hemothorax, and that both of these are slow to disappear. While it may be true that the lung may tolerate foreign bodies for a certain time, yet experi-

¹ Bull. et Mém. Soc. de Paris, 1915, xli, 2084.

² Ibid., 1916, lxxv, 275.

³ Presse Méd., 1916, p. 274.

ence in civil surgery shows that abscess or bronchiectatic cavity will develop in most instances sooner or later. Duval¹ discusses the late removal of intrapulmonary projectiles, and reports 40 cases. He considers that if the projectile is contained in an inflamed lung, operation is imperative; but if the lung is apparently normal, even though there is a hemothorax or adhesions, there may be some question as to operation. He uses the *x*-rays and the method of Hirtz for localization. Denéchau² has analyzed 50 chest injuries, clinically and radioscopically, at periods ranging from fifteen to twenty-four months after the injury. Eighty per cent. are in excellent condition, but all have certain symptoms referable to the injury. Pain provoked by movement, dyspnea on exertion, and dry cough are the chief symptoms. The majority have a notable diminution of thoracic expansion. Denéchau also calls attention to the possibility of latent infection, and believes that this is an indication which authorizes the systematic removal of such projectiles. Mauchaire concludes that they should be removed if they are causing any trouble, such as pain on respiration, difficulty in breathing, repeated hemoptysis, or signs of abscess. He does not advise operation if the projectile is more than 7 cm. deep in the lung.

Treatment of Severe Hemorrhage. In cases of severe hemorrhage the bleeding is increased by the suction excited by the movements of respiration. Plugging of the wound in the chest wall is extensively used, but Don³ believes it does more harm than good. He states that if immediate collapse of the lung can be attained, the wound may close and bleeding cease. He proposes a stab incision between the ribs and into the hemothorax; an "army tracheotomy tube" is slipped, one-half on each side of the knife, and pushed right in. The hemothorax may be aspirated by a soft catheter, if necessary. A trocar and cannula might be used in place of the tracheotomy tube. The tube is removed in twenty-four to forty-eight hours.

Foreign Bodies in the Respiratory Tract. The lodgment of foreign bodies in the trachea or bronchi is always an interesting condition of affairs, usually affecting a child, and calling for special skill in treatment. In many cases the history is sufficient to establish the condition, but in others the history is obscure, and the presence of a localized bronchitis, a pneumonia which fails properly to resolve, a lung abscess, a bronchiectasis, or chronic empyema should be investigated with the possibility of foreign bodies in view. In all such cases the patient should be submitted to a röntgenological examination. In PROGRESSIVE MEDICINE for March, 1916, I described several of these unsuspected cases. If the *x*-ray examination proves negative and the symptoms and history point to the possibility of foreign body, a bronchoscopic examination

¹ Rev. de Chirurgie, 1916, li, 365.

² Presse Méd., 1916, 329.

³ British Medical Journal, 1916, i, 816.

should be made. This subject has been well considered by Green and Lewald.¹ They offer the following conclusions:

"1. All recently aspirated foreign bodies should first be sought by the Röntgen rays and the bronchoscope, without delay, and removed, if possible, through the mouth.

"2. Failing to remove them through the mouth, a tracheotomy should be done and another attempt made by means of the bronchoscope.

"3. Failing in this, the tracheal wound should be held widely open by wires or a large tube, in the hope that the foreign body may be coughed out.

"4. If immediate removal by these methods fail, a period generally elapses in which the patient may undergo secondary changes in the lung, such a pneumonia, gangrene, abscess, and generally an overlying empyema.

"5. If the patients recover from these acute infectious processes they pass into the class of deferred cases, with the foreign body still present as an aggravating factor in their chronic lesion.

"6. Removal of the foreign body in these deferred cases does not always effect a cure.

"7. The lung abscesses must be treated along surgical lines, and even then we cannot always hope for a cure, but rather only an amelioration of their affliction."

I have referred to the importance of the *x*-rays in the localization of these foreign bodies, and Beck² describes, by some radiograms, the methods of localization.

Empyema. An interesting paper relating to parapneumonic empyema has appeared by Gerdine.³ He studied a series of 15 cases of typical lobar pneumonia or bronchial pneumonia in children under four years of age, exploratory punctures of the chest being made as early as possible in the course of the disease. In 6 of the 15 cases (40 per cent.) fluid was recovered by puncture before the seventh day, always before the crisis. After describing these cases in detail, Gerdine discusses the reported cases, 47 in number. From this study he concludes that in the majority of cases the fluid is serofibrinous in character, and contains a large cellular element. When there are no organisms the fluid may remain serous or serofibrinous, whereas the presence of organisms may lead to the formation of pus. The organisms may also differ in virulence, and this point is of importance in its bearing on treatment.

DIAGNOSIS OF EMPYEMA. Under the title of "Some Puzzling Features of Empyema," Pryor⁴ presents some very interesting suggestions relating

¹ *Annals of Surgery*, 1916, lxiii, 657.

² *Interstate Medical Journal*, 1916, xxiii, 259.

³ *American Journal of Diseases of Children*, 1916, xi, 33.

⁴ *New York Medical Journal*, 1916, ciii, 10.

to its diagnosis. He first discusses the difference between empyema in a child and in an adult. In the former the breath sounds, and the conduction of the voice through a large accumulation of fluid may be most deceptive when considered alone. The percussion note may be misleading in reference to the amount of fluid, and the heart may not be displaced in proportion to the amount of pressure. The following should be borne in mind:

"1. Exclude other conditions, particularly pneumonia.

"2. Remember the possibility of associated pneumonia.

"3. Obey the cardinal rule of physical diagnosis; compare, always compare. The sounds on the affected side are practically always different in quality and degree to a trained ear. There is almost always a perceptible difference if the child's voice sounds can be elicited by palpitation.

"4. Employ the role of gravity by change of position and mark the altered levels of the fluid. It takes longer for the thick pus to gravitate to a new area than thin serum."

Pryor next considers the value of needle puncture, and emphasizes the necessity of having sharp needles and a proper technic. I have emphasized this point in these pages several times. He gives the following physical appearance as almost characteristic of fluid in the chest.

"One shoulder is lifted and there is partial immobility of the affected side in the region of the abdomen near the diaphragm. This is accompanied by an increased distance between the spine and scapula if the fluid exists in considerable amount."

In the adult the diagnosis should be easy, particularly if the needle is used when there is doubt. In addition, a fluoroscopic screen is of value when it can be used. In tuberculous empyema, Pryor believes that thoracotomy should be avoided, if possible, and aspiration be resorted to in preference. This point has been emphasized by many other writers. Pryor also includes in his article a form of treatment for tuberculous empyema employed by Garvin:

"Through two needles, one for aspiration and one for the inflow of normal saline, 17 quarts of fluid were introduced and withdrawn, keeping the patient in perfect balance during the entire procedure. A stoppered wash-bottle was used in the introduction of the fluid, and a similar bottle at the exit of the fluid, so the quantity relations were always the same.

"As a result there was obtained about 1000 c.c. of wet sediment consisting entirely of cell detritus and innumerable tubercle bacilli. Three weeks later the procedure was repeated, using a lesser quantity, about 800 c.c. The sediment in this instance was slight and the fluid slowly absorbed, and the patient returned to his previous state, with the disappearance of the tuberculous empyema after about sixteen weeks.

"The needle tracks, following the removal, developed slight necrosis at the skin punctures (probably tuberculous skin inflammations), which healed promptly."

SURGICAL TREATMENT OF EMPYEMA. Two important articles on operative treatment appeared last year, one by Lilienthal and Ware¹ and the other by Robinson.² The first of these is, in a sense, an elaboration of the article by Lilienthal described last year, in which he described the operation which he now calls "Major Intercostal Thoracotomy with Exploration and Lung Mobilization."

"Briefly, the steps of the operation are as follows: (a) Skin and muscle incision in the seventh or eighth interspace. Line of incision from the angle of the ribs to the anterior axillary line, more or less, and close to the upper border of the lower rib, to avoid nerves and vessels. (b) Pleura entered carefully to avoid possibly adherent lung. (c) Rib retractor inserted and the ribs separated from four to six inches or more. If still greater room is needed, cut a rib or two above or below the wound at the posterior angle. (d) Exploration: Removal by suction or sponging of all pus and coagula, then inspection and palpation of lung and pleura.

"Adhesions to the chest wall should not be disturbed unless they separate easily. If the lung expands and fills the chest when the patient strains, and if no sign of lung abscess or fistula is present, the soft parts of the wound may be approximated with chromicized gut and the skin partly closed by suture.

"Because of the division of the intercostal muscles the ribs will not at once fall together. There will be a space of an inch and a half or more (in adults), which will persist for some days. Drainage openings of suitable sizes anteriorly or posteriorly, or both, may be left, but it is not often necessary to put in tubes or gauze. Should an inoperable pulmonary suppurating lesion be encountered—bronchiectasis or lung abscess—better resect a piece of rib with the periosteum so as to permit of long-continued drainage without a tube and without the danger of valve formation and tension pneumothorax.

"If the lung is bound down by tough exudate upon the pleura, this should be divided by a long vertical incision (Fig. 11), when the lung will usually try to force its way out of its confining membrane. Peeling this away with the fingers (Fig. 12) the lung may be further freed by incisions at right angles with the first one (Fig. 13). Hemorrhage is moderate and often absent. A slight wound of the lung tissue is not serious. Tough adhesions of the lung to the chest wall had better not be disturbed unless they are capable of being divided between ligatures. The loose flaps of membrane peeled from the lung may be cut away, but there should be no special effort made to denude every portion of the lung's surface.

"During the procedures just described, secondary abscesses may be

¹ Medical Record, 1916, xc, 89.

² Surgery, Gynecology and Obstetrics, 1916, xxii, 557

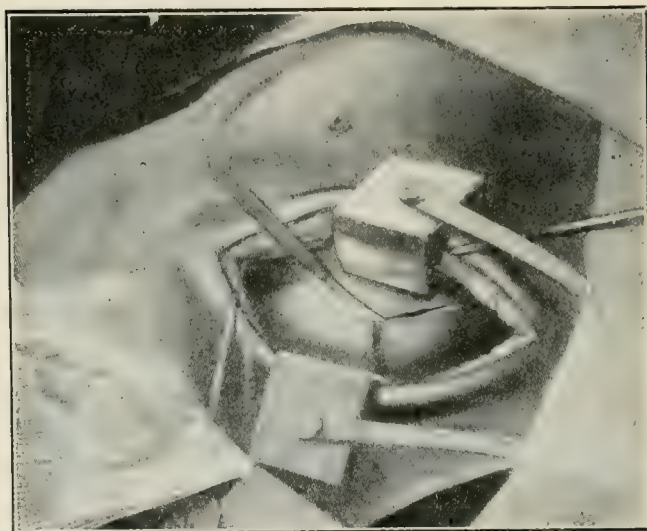


FIG. 11.—Rib retractor in place. Knife incising pleural exudate.

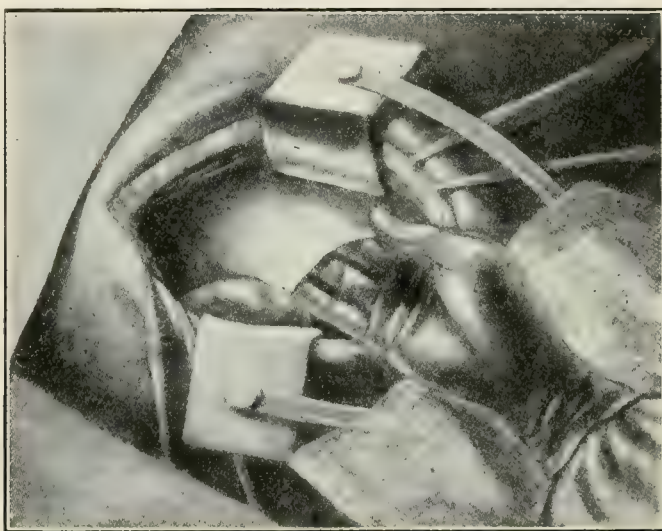


FIG. 12.—Stripping exudate from pleura. Lung bulging below.

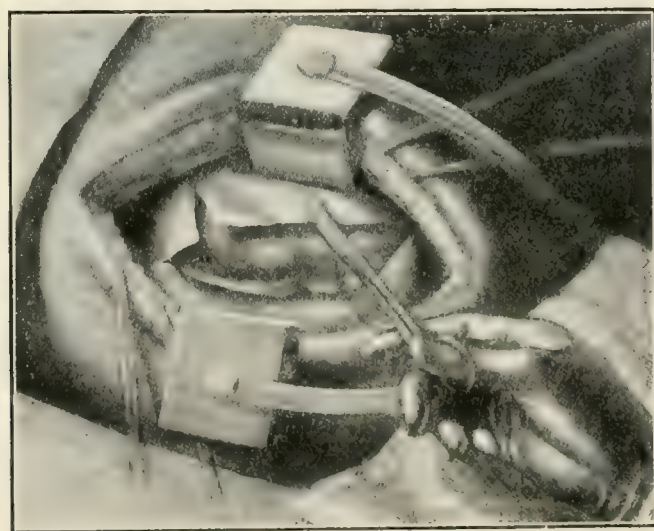


FIG. 13.—Lateral incisions made with scissors. Lung bulging out. Part of this exudative membrane may be cut away.

found and turned into the main cavity. Sometimes the lower lobe of the lung is adherent to the diaphragm. This adhesion should be loosened with the greatest caution for fear of entering the abdominal cavity. We have several times encountered, between lung and diaphragm, collections of pus which must have caused serious complications had they not been emptied.

"Having mobilized the lung, the wound is closed with tubeless drainage as just described."

He has performed 26 of these operations with 5 deaths, and believes that by such means pockets of pus are discovered which could not otherwise be found. The operation is not indicated primarily in desperately ill patients, but should follow minor thoracotomy (the old operation) done for immediate relief.

Gatch¹ doubts the value of such wide-spread exposure for the detection of localized empyemata, etc., because stereoscopic radiographs are able to locate such collections with equal facility; but I have found, except in the most expert hands, that such radiographs are often deceptive or disappointing. I can agree with Gatch in his other contention, namely, that such an extensive incision is not necessary in the ordinary postpneumonic empyema if the operation is not delayed too long.

Lilienthal's efforts have been specially directed toward improving the method of operating in the acute form, whereas in the second paper above mentioned, that of Robinson, an effort is made to improve the technical procedures employed in the treatment of chronic empyema. Robinson emphasizes three points in his article: (1) The necessity of obtaining an accurate knowledge of the size and position of the cavity. This is best done by packing it with gauze strips saturated with barium sulphate and then having a stereoscopic radiograph taken. (2) The method of procedure in each case should be adapted to each particular cavity and the equipment of the surgeon should not consist solely in a knowledge of the technic of some one of the standard operations. (3) Robinson offers a series of procedures to be followed in the ordinary chronic case.

BECK'S BISMUTH PASTE IN EMPYEMA. I have referred to the use of Beck's paste when discussing Robinson's article. Beck² refers to incorrect technic as a cause of failure in its application, and in a table of cases, without details, however, shows marvelous results in empyema. He now uses only 10 per cent. of bismuth subnitrate in petrolatum for empyema.

ASPIRATION DRAINAGE. Massini³ is an advocate of aspiration drainage (Perthes). After puncture and aspiration of the pus, he waits three or four days, and if the pus then reaccumulates, he establishes suction

¹ Journal Indiana Medical Association, 1916, ix, 190.

² Journal American Medical Association, 1916, lxxvii, 21.

³ Therap. Monatshefte, 1915, xxix.

drainage by means of a Wolff bottle with three openings, one connecting with the drainage tube, one to the pump on the water faucet, and the

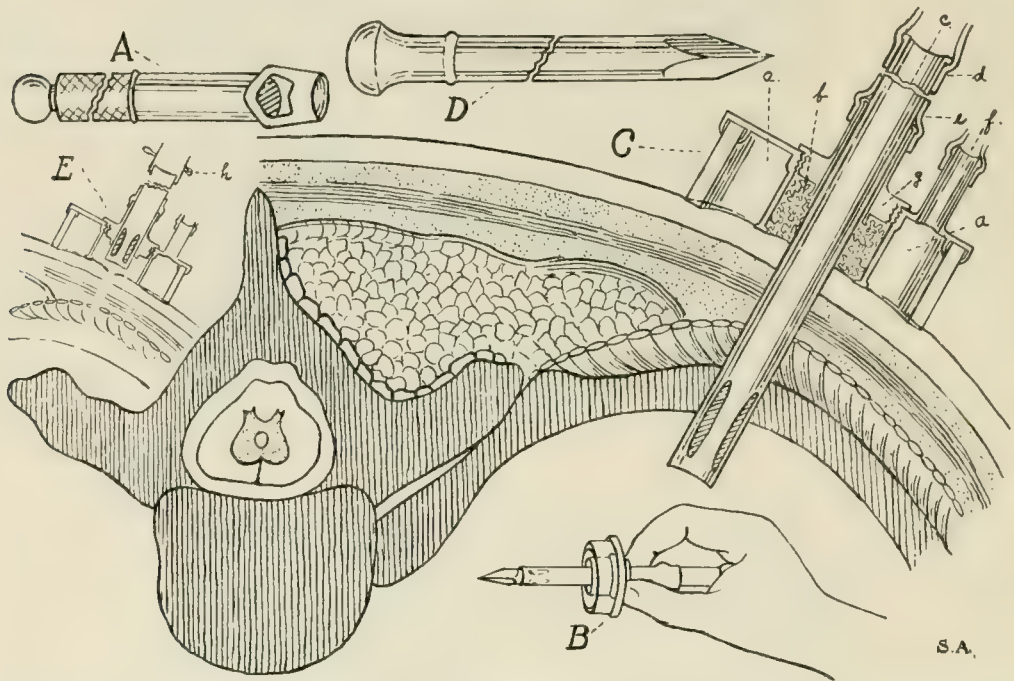


FIG. 14.—Apparatus for drainage of pleural cavity. *A*, circular knife (28 French) for removing a circular piece of skin exactly corresponding to the size of the drainage tube; *B*, apparatus with trocar held ready for introduction; *C*, apparatus in position; *D*, trocar; *E*, position of drainage tube after its removal from the pleural cavity.

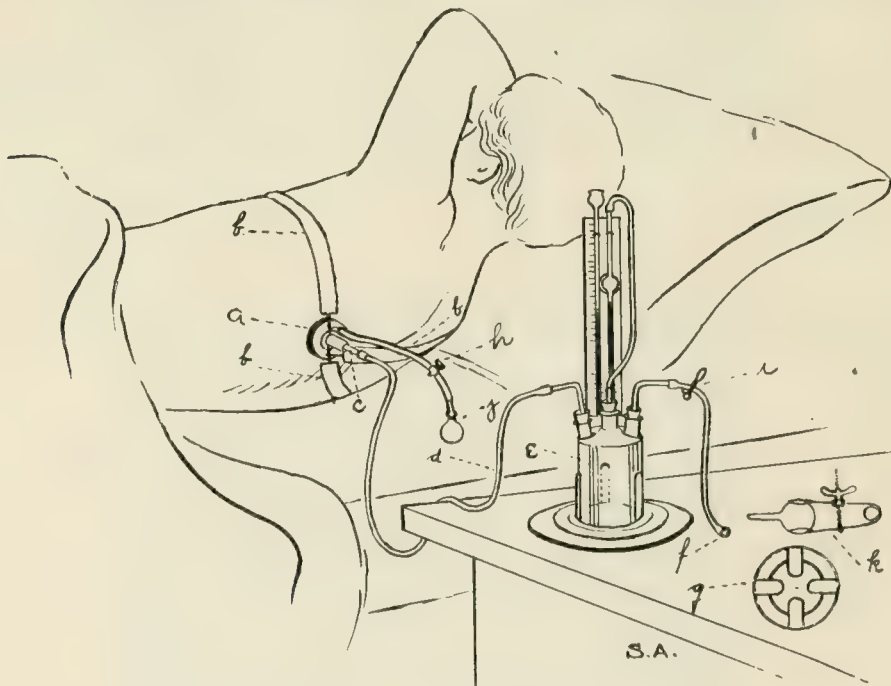


FIG. 15.—Apparatus in position.

middle opening containing a manometer. If the drainage tube plugs, he flushes out the cavity with potassium permanganate solution (1 to 5000) under low pressure, injecting 10 to 20 c.c. at a time until a few

hundred cubic centimeters have been injected, when the solution is allowed to flow out. He emphasizes the value and importance of breathing exercises in the after-treatment. Lerche¹ describes a similar apparatus, except that he uses a complicated trocar and cannula which has a circular chamber attached to the cannula, from which the air can be exhausted by a suction bulb acting as a "sucker" and holding tightly to the skin. Ransohoff² describes a technical device for use in empyema, drainage consisting of a collapsible soft-rubber tube fitting accurately over the harder drainage tube for about an inch. Any effort at inspiration will cause the soft outer tube, which is led into the bottle, to collapse, while expiration opens it up and permits the escape of pus. I have seen this described before and have used it twice, both times without success.

The article of Massini reminds me of the frequent efforts on the part of surgeons and writers to find some substitute for the usual thoracotomy with drainage. The treatment of pleurisy with effusion depends to a large extent upon the character of the fluid. The aspirating needle will show this character, and if it is serous or serofibrinous, aspiration alone will usually effect cure. When the effusion is turbid, however, the proper procedure becomes more difficult to determine. If it is not frankly purulent, and even if pneumococci can be determined in the cover-glass smears, I believe that thoracentesis should be tried first and the patient carefully watched for the recurrence of the effusion, and suggest the further tapping to determine its character. If the leukocytes in the sediment become more abundant, and if they show evidence of necrosis, operation is usually necessary. A purulent exudate may exist in spite of the negative bacteriological findings, but it is probable that the organisms have been present at one time or another. In frankly purulent effusion an immediate and free drainage of the cavity is necessary, aspiration will fail in the majority of cases, and there is no excuse for avoiding a free opening except in desperately ill patients. In tuberculous empyemata, great caution should be exercised before establishing a sinus, and in these cases thoracentesis should be tried. I have had no experience with the so-called auto-inoculation whereby a portion of the fluid is removed and reinjected into the tissues of the patient.

I note that Nilson³ agrees with this statement and believes that those cases healing after simple aspiration should be classified as seropurulent pleurisy rather than empyema. He reports that in the hospital at Karlskrona, during the period from 1903 to 1915, there were 465 cases of acute pneumonia, and of these, 32 (6.8 per cent.) developed empyema. There were 3 deaths, or 9.3 per cent., which compares most favorably with all the other figures hitherto published.

¹ Journal of American Medical Association, 1916, lxvi, 1621.

² Ibid., 1196.

³ Nord. Med. Ark., 1916. Abs. in Surgery, Gynecology and Obstetrics, 1916, xxii, 595.

Interlobar Empyema. Greer¹ reports favorably upon the use, in one case, of artificial pneumothorax by nitrogen gas in an acute interlobar empyema which was draining through the bronchus. Three injections were given and recovery was uneventful.

Gorter² reports two cases of interlobar empyema in infants, one fifteen months old and the other five months. Both cases were cured by simple puncture in the sixth interspace.

Double Empyema. An interesting case of double empyema in a girl, aged sixteen years, is reported by Lund and Morrison.³ The case followed pneumonia, and on the fifteenth day of her illness the provisional diagnosis of double empyema was made. Paracentesis of both sides of the chest was done, with no result. Four days later she began to cough up a great deal of foul pus, and three days later pus was obtained from the chest. Resection of a rib on the left side and evacuation of pus failed to improve the patient until a rib on the opposite side was resected and the second empyema evacuated. Complete recovery finally occurred.

There were certain interesting features about the case. The x-ray plates showed merely a general haziness of the lower part of the chest, and percussion also failed to reveal the cavities. Lund gives special attention to the necessity of exploring the space between the inner surface of the posterior aspect of the lobe and the spine when a negative result has been obtained in the usual locations. He also opens up the question as to whether, when the history and physical signs strongly favor the presence of pus but aspiration is negative, the chest should not be opened and a search made under the guidance of the finger.

Abscess of the Lung following Tonsillectomy. One usually thinks of tonsillectomy as a simple procedure, the only complication of which is hemorrhage. For this reason the report of Manges⁴ is unusually interesting. He reports 9 cases in adults in which abscess of the lung occurred after simple tonsillectomy. The symptoms appeared on the first day in 2 cases; on the second, third, and fifth days in 1 case each; on the seventh day in 2 cases; and on the tenth and fourteenth days in 1 case each. He believes that in the causation of these abscesses there may be several factors to be considered: "(1) The anesthesia. (2) Aspiration of infected blood or of pieces of tonsillar tissue. (3) Embolism or infarction of the lung. (4) Some special infective agent. (5) Some antecedent cause, either local or general." Manges believes that the aspiration of blood or pieces of tonsillar tissue is the most important single cause, especially in those cases in which the symptoms develop immediately, or one or two days after the operation. Aspiration may also be the

¹ Journal of American Medical Association, 1916, lxvi, 1019.

² Arch. de Méd. de Enf., 1916, xix.

³ Boston Medical and Surgical Journal, 1916, clxxv, 606.

⁴ American Journal of Surgery, 1916, xxx, 78.

cause in those cases developing a week or several days later, the difference in time of onset being due to variations of the size of the aspirated bits of tissue, and differences in the local conditions of the lungs, or variations in the resistance of the patient. He quotes a series of complications after tonsillectomy reported by Bassim,¹ in which pulmonary complications occurred in 19 cases, with 4 deaths. There were 2 cases of fetid bronchitis; 7 of bronchopneumonia; 5 of lobar pneumonia; 3 of lobar pneumonia and gangrene; 1 of purulent pleurisy, probably due to rupture of pulmonary abscesses; 1 of abscess of the mediastinum.

I find that the cases reported by Manges have also been reported by Wessler.² He gives a complete tabular report of the cases and reproductions of the röntgenograms of all of them.

Richardson³ reports 3 cases of this occurrence, all of which recovered. Coakley,⁴ in the discussion of Manges's paper, calls attention to the necessity of restricting bleeding. Yankauer, in the same discussion, believes that the most important point in preventing abscess is the previous preparation of the patient. The patient should not take any food for twelve hours before operation. This preparation is not carried out in any hospital; the children are admitted a few hours before being operated on and are sent out before twenty-four hours have elapsed.

Bronchiectasis. In *PROGRESSIVE MEDICINE* for March, 1915, I described a paper by Lilienthal on pulmonary abscess and bronchiectasis in which he reported 12 cases treated by palliative treatment. In a recent paper he⁵ reports 7 cases of chronic, non-tuberculous pulmonary suppuration in which extirpation, or attempted extirpation, of the lesion was done. The most important sign of this disease is cough, with profuse mucopurulent and sometimes fetid sputum. Irregularity of fever and clubbing of the fingers are seen, and the physical signs are well known. The radiograph and the bronchoscope are valuable diagnostic methods. The use of the bronchoscope in bronchiectasis has been described by Yankauer.⁶ He states that endobronchially we can distinguish three groups of cases:

"In the first of these there is a dilatation of one or both of the main bronchi. This dilatation can be distinctly recognized through the bronchoscope. It may be limited to the main bronchus or it may include the beginnings of the secondary branches. The enlarged bronchus contains the secretion, and its walls are covered with a thick layer of glairy, tenacious, and cloudy mucus. In the other two groups of cases the main bronchi are not apt to be dilated. In fact, if pleuritic effusion is

¹ Thèses de Paris, 1913, No. 181.

² Interstate Medical Journal, 1916, xxiii, 5.

³ Laryngoscope, 1916, xxvi, 1001.

⁴ Ibid., 1008.

⁵ Annals of Surgery, 1916, lxiv, 8.

⁶ New York Medical Journal, 1916, ciii, 257.

present, the main bronchus may be considerably smaller than normal. The main bronchus contains secretion, but even when the secretion has been evacuated with the suction apparatus, the pus continues to reappear from the smaller bronchi, from which it can be seen to ooze during the entire examination. From the surgical stand-point, it is of the utmost importance to distinguish two classes of such cases; in one the pus is seen coming from all the smaller bronchi, on one or both sides, and in one such case seen in Lilienthal's service, autopsy showed the existence of numerous peribronchial abscesses, each emptying into one of the smaller bronchi; in the other group of cases, after the main bronchus has been emptied of pus and the pus continues to reappear, it can be distinctly seen that the pus originates from a single branch only. We are thus able to distinguish with the bronchoscope cases of diffuse dilatation of the larger bronchi, cases of multiple peribronchial abscesses, and cases of abscesses involving only one part of the lung. The latter group of cases are the most favorable for surgical intervention."

In discussing *treatment*, Lilienthal states that palliative treatment should be reserved for actually hopeless cases, when there is bilateral involvement or when the disease is very wide-spread in one lung and there are so many adhesions that extirpation is impossible. He reports 2 cases, however, to show that even when an abscess has extended so as to implicate a neighboring lobe in one single mass, extirpation may be performed.

During the twenty-four hours preceding the operation, the patient should be placed in that posture which will cause a partial or complete emptying of the cavities. One hour before operation morphine or atropine is given, and before administering the anesthesia the thighs close to the body are compressed with rubber bandages, so as to segregate the blood in the lower extremities. Ether is used only sparingly, most of the anesthesia being conducted with nitrous oxide and oxygen. If ether is used, he prefers the intrapharyngeal method. The patient should lie upon the healthy side or a little over toward the prone position. If the lower or the middle lobes are to be exposed, the incision is made in the seventh or eighth interspaces, beginning at the angle of the ribs and running forward to the anterior maxillary line, or even farther. The muscles are divided, the ribs separated with blunt retractors, and the pleura carefully and slowly incised. The rib-separating retractor is then adjusted and the ribs slowly forced apart. If they cannot be separated sufficiently, the adjoining rib at either end of the wound may be divided. Exploration will now reveal the dusky red, diseased part in strong contrast to the normal lung. The lung is then freed from its adhesions to the chest wall and isolated from the adjacent healthy lobe. Adhesions between the uninvolved lobe and the chest wall should not be disturbed. Lilienthal then crushes the entire pedicle with a powerful

clamp, and ligates the pedicle with chain ligatures of strong chromicized catgut. After cutting away the lobe, the vessels are secured separately beyond the ligature and the bronchial stumps carbolized and once more tied, but with no attempt to invert. If there are no adhesions between the remaining lobes and the chest wall, the stump is fixed by fastening it to the chest wall by a transfixion ligature, and a single packing of gauze is laid against the stump and led out of the wound. The latter is then closed with chromicized catgut and the skin with silk. Convalescence is apt to be stormy, and it may be necessary to increase the drainage by an insertion of a rubber tube. He keeps the discharge of pus from accumulating by means of a suction apparatus. There may be a temporary bronchial fistula which soon becomes obliterated. In one case he modified the operation, because of the necessity of resecting a part of the lobe, by crushing the healthy lung beyond the abscess and suturing it with chain ligatures. When the wound has become simplified, but healing is slow, he has found that the injection of 5 per cent. iodoformized vaseline stimulates repair and greatly reduces the quantity of discharge. The patient should be given open-air treatment, forbidden to take active exercise, and have special attention given to any tendency to cough. Of the 6 cases in which the operation was completed, there were 4 cures.

A brief review of this subject and the report of a fatal case is presented by Mayne.¹ In the discussion of Mayne's paper, Westbrook reported a case operated on in several stages, but which finally succumbed to the last operation.

Yankauer has reported a method for handling those cases which are not amenable to surgical treatment. He introduces a tube through the bronchoscope into the bronchiectatic cavity.

"Through the smaller tube normal saline solution is injected, while at the same time suction is applied through the larger tube. The fluid is removed as fast as it enters the bronchus. By directing the tube to various parts of the wall of the cavity, a thorough irrigation is accomplished. It has been possible in this way to irrigate each lung with about 8 ounces of salt water at one sitting, under local anesthesia. The patients feel the solution enter the chest and can tell when it has been removed. They do not object to the procedure. After two or three such irrigations, the foul odor of the secretion disappears and the amount becomes very markedly reduced. Unfortunately, this beneficial effect does not last more than a few days, so that the irrigations must be repeated. He has done this in three cases, with good results as far as the odor and quantity of secretion are concerned, but none of the cases has been cured. Nevertheless, the result is striking, and it seems well worth while to continue to attempt to treat these very unfortunate patients in this way."

¹ New York Medical Journal, 1916, ciii, 447.

Zaaijer¹ reports 4 patients with bronchiectatic cavities, all of which were materially benefited or clinically cured by the subperiosteal resection of from 13 to 20 cm. of four or five ribs, suturing in two tiers with a compressing pad above. There was return of trouble in one case which is now demanding the more complicated intervention. McCrae and Funk² report the histories of 5 cases in great detail, together with the necropsy findings. It is noteworthy that they do not even suggest surgical treatment for this disease.

BRONCHIECTASIS DUE TO FOREIGN BODIES. While admitting that he may be biased, Jackson³ cannot but feel that the relatively minor place attributed by medical literature to foreign bodies as a cause of bronchiectasis is an error. He reports 5 cases illustrative of his standpoint. The first 2 cases giving no history of having swallowed the foreign body, and in the third the nail had probably been *in situ* for three years. Another patient was treated for cough and expectoration of foul pus for three years, but the foreign body was recognized in the right bronchi and finally removed. The following conclusions are offered by Jackson:

"1. Every case of bronchiectasis, chronic bronchitis, pulmonary tuberculosis, pulmonary abscess, and of chronic cough should have a radiograph taken, regardless of how certain we may be of our diagnosis.

"2. Every case in which the patient mentions the possibility of having aspirated, 'swallowed,' or 'choked on' a foreign body should be studied radiographically, and, if any symptoms of bronchial irritation arise, the patient should be bronchoscoped anyway, even in case of a negative radiograph.

"3. In all cases with a foreign-body history, in which the foreign body is one not dense to the ray, a radiograph should be made anyway, and in most cases a bronchoscopy should be done also.

"4. In case any foreign body opaque to the rays having been 'swallowed', the foreign body must be located with the rays or definitely proved not to be present in the body. Strange as it may seem today, patients are still told to 'go home and forget about it.'

"5. A condition of 'drowned lung,' differing from pulmonary abscess in that the pus is contained in otherwise normal passages, may arise from the obstruction of a foreign body; and this condition may strongly simulate bronchiectasis. True bronchiectasis may follow if the foreign body is not removed."

In *PROGRESSIVE MEDICINE* for March, 1916, I mentioned the case of a child who, for six years, had had a foreign body in the lung, and suffered during that time from cough and fetid expectoration. The nail was located in a bronchiectatic and abscessed cavity and removed by thora-

¹ Abstract, *Journal American Medical Association*, 1916, lxvi, 1282.

² *Ibid.*, lxvii, 1060.

³ *Pennsylvania Medical Journal*, 1916, xix, 807.

cotomy in October, 1915, the child did well except for a persistent sinus, and later the sinus would close up and the symptoms recur. After several small operations, I removed the lower lobe of the lung in September, 1916, but death occurred two weeks later.

Dermoids of the Mediastinum. According to Hertzler,¹ there are only 72 cases of this affection reported in the literature. The majority have been observed in early adult life, although the extremities of life are not exempt. The symptoms may be considered under two headings: (1) Those due to pressure. (2) Those due to irritation of the surrounding structures. Cough and dyspnea and symptoms shown occur in the first group. Irritation of the pleura may simulate pleurisy, exudation about the tumor may simulate pneumonia. Dulness to percussion over the sternum is an important symptom, and, in 8 cases, examination of the sputum has given positive results by the discovery of hair in it. Hertzler believes that surgical treatment alone can be of avail. Of the 27 cases operated on, there was recovery in 5, improvement in 13, indeterminate results in 4, and death in 5. In most cases an incision and drainage, with the excision of the polypoid mass, has been the treatment employed. Total extirpation would be the ideal treatment. A bibliography is appended to the article.

Suppuration in the Posterior Mediastinum. Papers upon the surgical treatment of disease of the mediastinum are rarely seen, partly because of the rarity of this disease, and partly because of the difficult access for surgical treatment. Gaudiani² reports 2 cases of suppuration of the mediastinum and discusses the literature. The first patient was a man of sixty-two, suffering from diabetes. He first had pain on the left side of the neck, then difficulty in swallowing, and then a mass appeared at the base of the neck. There were fever and dysphagia. The second case, a man forty years of age, had swallowed a fish-bone a week previous, and, when seen, was suffering from fever and dysphagia, and, later, suppuration at the base of the neck. Both cases were treated by an incision just above the clavicle and over the anterior margin of the sternocleidomastoid muscle. In both cases a large cavity was found, extending behind the esophagus for six or seven inches. The second case died from bronchial pneumonia. He notes there are two methods known for opening and draining retromediastinal abscesses: (1) The dorsal mediastinotomy proposed by Nasillow, in 1888; (2) the cervical mediastinotomy (collar mediastinotomy, von Hacker). Gaudiani believes that the dorsal incision is indicated for cavities located low in the mediastinum below the passage of the aorta, from the fourth to the fifth dorsal downward. All abscesses situated at the level of, or above, the fourth dorsal may be successfully opened and drained through a cervical incision. Only secondarily a dorsal mediastinotomy may be necessary.

¹ American Journal of the Medical Sciences, 1916, clii, 165.

² Annals of Surgery, 1916, lxiii, 523.

Wounds of the Thoracic Duct. This subject has not been discussed since 1908, when DeForest's paper was abstracted. A few contributions have appeared since that time, and, in 1912, Zesas described 49 cases in detail. Last year, Harrison¹ reported a case of a boy, nine years old, who suffered from an enormous mass of glands in the neck. These were dissected out and during the operation the thoracic duct was divided in the neck. The injury was recognized, and, as the external jugular vein had also been divided, the thoracic duct was slipped into the vein and sutured in place. The wound healed, and in several weeks' time he was discharged in good health, except for a persistent slight fever in the evening. Harrison reviews the literature and discusses the four methods of treatment advocated:

1. Suture: If this can be done, either in a lateral tear or in a complete rupture, it should be tried, and it is the ideal method of treatment.

2. Implantation of a Vein: If suture cannot be done, this method seems to be the most rational procedure. He does not think that the retrograde flow of blood will start any thrombosis nor would he hesitate to divide the clavicle unless such division would give better access to the duct.

3. The occlusion of the divided duct by ligature or forcible pressure. This method may be used if the surgeon follows up the vessel and finds the second terminal branch, because, if there is no such branch, there will be a long convalescence, during the weeks of which the patient will emaciate and suffer grievously from thirst.

4. Tamponade. This is only a *dernier ressort*.

Harrison makes some observations of the problem from the physiological point of view: "Why should the patient whose duct has been tied suffer so much from hunger and thirst if sugar and peptones are carried by the veins of the intestines to the liver, and probably a sufficient amount of water is absorbed by the same route?" He believes that the lymphatics of the trunk, lower limbs, and the abdominal organs are blocked, and consequently the nutrition of these parts must suffer. For the same reason the liver is hampered in its functions. A full bibliography is appended to the article.

Chylothorax. Lewin² reports an interesting case in which the patient developed a lymphosarcoma of the mesentery. Metastasis occurred, the tumor growing in the duct, and the metastases in the mediastinal lymph glands caused obstruction of the duct with consequent transudation of chyle into the pleural cavities. A diagnosis was established by the physical findings of dulness in the chest by a positive x-ray finding of fluid, by aspiration of chylous fluid which had a specific gravity 1017; was alkaline, positive to albumin, negative to sugar, and contained a large amount of fat and 0.6 per cent. of urea.

¹ British Journal of Surgery, 1916, iv, 304.

² American Journal of the Medical Sciences, 1916, clii, 71.

Cases of chylothorax, and reviews of the literature, have also been recorded by Outland and Clendening¹ and by Tuley and Graves.²

Stricture of the Esophagus. The procedure adapted by Bassler³ in a case of impassible esophageal stricture is quite interesting. A child of three swallowed some caustic lye and later developed dysphagia, increasing until finally he could not swallow the smallest quantity of fluid. After gastrotomy, the Abbe string-cutting method was employed until a No. 34 F. could be passed from below up. The operation was followed by the passage of tunnel bougies, but gradually the stricture closed and in three months' time a No. 18 F. olive could no longer be passed through it. During this time he was fed through the gastric fistula. Many other attempts were made with various devices, and at the end of a year's time the stricture would only permit the passage of a No. 20 F. olive. At the end of this time the child could swallow small quantities of fluid but no semisolids or solids. Bassler then attained success by the following procedure:

"Giving the child a teaspoonful of olive oil to swallow, wrapping him up in a blanket so that he could not fight with his hands and feet, putting in a mouth-gag of the form used in O'Dwyer's intubation set, with the child's body flat and the head extended in a typical gastroscopy position, and about three people to hold him, a filiform whalebone, of the kind used to pass a prostatic stricture, was passed into the stomach, the upper end of the filiform being held by a nurse. On this filiform, which is a yard in length, funneled bougies were run through the stricture, gradually increasing it in size in a year's time so that a No. 35 F. could be sent through. At a number of the times after passing a fairly large-sized olive, elastic esophageal sounds were used, allowing the largest possible to get through and remain in the esophagus for some minutes.

"At the present time the child requires to have the stricture kept open by dilatation about once every eight weeks, and he is perfectly well, being able to swallow anything. By constant instrumentation, and according to the feeling, the stricture is not only enlarging in caliber, but also is not so dense as it was."

Esophagoplasty. An interesting description is given by Axhausen⁴ of the technic of Roux and Lexer, whereby an artificial esophagus is made from a loop of duodenum. The patient had suffered from a stricture of the lower esophagus after swallowing caustic. Five separate operations were required, but in six months the new esophagus seemed to be functioning well, fluids and foods passing into the stomach from gravity and the mechanism of the pharynx.

¹ Journal of American Medical Association, 1916, lxvi, 1833.

² Ibid., 1844.

³ Ibid., 1198.

⁴ Berlin. klin. Wehnschr., 1916, liii.

INFECTIOUS DISEASES, INCLUDING ACUTE RHEUMATISM, CROUPOUS PNEUMONIA, AND INFLUENZA.

By JOHN RUHRÄH, M.D.

The Etiology of Respiratory Infections. The various respiratory infections which are generally rather loosely described by the term *grippe*, have never seemed to have been studied as thoroughly as they should be. Two contributions have recently been made, one by Capps and Moody,¹ and the other by Mathers.² Mathers studied the epidemic as it occurred in Chicago last year, making cultures from the sputum, nasal discharge, and the pharyngeal mucosa. Twenty-four cases in all were studied, and in 17 instances he found a hemolytic streptococcus to be the predominating organism. This grows in small, white, semitranslucent colonies on blood-agar plates, and surrounded by a clear zone of hemolysis. In stained smears these organisms are small Gram-positive micrococci arranged in pairs and chains. Chain formation is marked, however, in broth cultures. Culturally, the organism presents the characteristics of the common *Streptococcus pyogenes* type. The cultures also contained *Streptococcus viridans* and pneumococci. Four of these pneumococcus strains were studied biologically; three were found to belong to the group commonly found in the mouth, and the fourth exhibited all the characteristics of *Pneumococcus mucosus*, and the patient from whom it was isolated died from a complicating lobar pneumonia. Mathers did not find the *Bacillus influenza* or the *Micrococcus catarrhalis* in any of his cultures. The *Streptococcus viridans* and the pneumococcus are normally found in the mouth, but the hemolytic streptococci are not ordinarily found apart from tonsillitis, so that it would seem that it could be credited with producing the pathological changes. The relation of Tunncliffe's *Bacillus rhinitis* to epidemic respiratory infections has yet to be worked out, and to do this it will be necessary to make cultures very early in the course of the disease.

Williams,³ of the New York City Health Department, made a study of the throat cultures from 50 cases in whom the diagnosis of *grippe* had been made. She found a streptococcus in 26, a pneumococcus in 19,

¹ Journal of the American Medical Association, November 4, 1916, p. 1349.

² Ibid., January 1, 1916, p. 30.

³ Bulletin of the Department of Health in New York City, February, 1916.

the *Micrococcus catarrhalis* in 18, and the influenza bacillus in 9, together with other less important organisms.

Earlier in the year, Moody and Capps¹ examined 31 cases, all of which showed the *Streptococcus viridans* and the pneumococcus, together with the hemolytic streptococcus in variable numbers, and they found the influenza bacillus but twice. They have corresponded with workers in various cities, including Philadelphia, Baltimore, Boston, Cincinnati, and San Francisco, and in these cities the influenza bacillus is rarely found in the throat or in sputum cultures. Whether this is due to the absence of the organism or to the examinations having been made too late, after the influenza bacillus was more or less crowded out by other organisms, will have to be determined by further observations, but the few instances in which the cases were studied early did not show it. One must also bear in mind that some filterable virus may be a possible factor in this connection, in regard to which the observations of Kruse, and more recently of Foster, are of particular interest. This is noted under the heading of "The Etiology of Common Colds." Moody and Capps raise the interesting question as to whether or not Pfeiffer's influenza bacillus really was the cause of the pandemic of grippe of 1889 and 1890. Pfeiffer did not publish his discovery of the organism until 1892, having isolated it from a recurrent epidemic. The disease is probably spread directly from one person to another, but attention has been called to a curious fact that in many large institutions, as prisons and hospitals, the inmates were found to be almost immune, while the disease was prevalent among attendants, employees, and visitors. The explanation of this phenomenon is not clear at the present time.

Mixed Vaccines. I have commented several times on the work of Castellani, who was the first to propose the use of mixed vaccines. This was based on experimental work done in 1901 and 1902, and since 1905 he has used the mixture of typhoid, paratyphoid A, and paratyphoid B with considerable success, and I noted last year the results of such vaccines as was shown by the report from the Japanese navy. In addition to this, he suggested the use of what he calls his tetravaccine, typhoid, paratyphoid A, paratyphoid B, and cholera or typhoid, paratyphoid A, paratyphoid B, and Malta fever; and he has also suggested the use of a pentavaccine of typhoid, paratyphoid A, paratyphoid B, cholera, and plague.

Lurie, attached to the American Red Cross commission in Serbia, has reported briefly the results obtained with tetravaccine made with the cholera germ, and also pentavaccine. In both cases, the vaccine was obtained from Castellani himself. Lurie² used the tetravaccine to inoculate 3000 persons, most of whom he was able to follow for two

¹ Journal of the American Medical Association, May 27, 1916, p. 1696.

² British Medical Journal, January 8, 1916, p. 45.

months after inoculation. Two injections were given at an interval of from five to seven days. The local reaction was trifling, and the general reaction, as a rule, was mild. In 2000 of these cases in which close observation was kept, no case of typhoid, paratyphoid A, paratyphoid B, or cholera developed among them for a period of two months.

The pentavaccine was used in some 2000 cases, with no untoward accident of any kind. The blood examination, made to test the results of agglutination, showed about the same results as those obtained in control individuals inoculated with control vaccines by Castellani and Mendelson. If some of the figures obtained are lower, they are not distinctly so. He concludes that both of these vaccines are harmless and should be used as a matter of routine where such diseases exist already or may be easily imported. After knowing the conditions such as are found in Serbia at the time this work was done, one can readily see the saving in time and labor of the use of mixed vaccines. Perhaps the reason that mixed vaccines have not found their way into more general use has been the sweeping condemnation from certain leaders of the American profession. It would seem that the stand taken by certain influential leaders and journals would now have to be changed to conform to what seems to be demonstrated as the truth concerning mixtures of the various vaccines.

Bacterium Tularensis in California. A couple of years ago this bacterium was described by Wherry, of Cincinnati, as occurring in an extensive epizootic of this plague-like disease among rabbits. In connection with Lamb he also reported 2 cases of human infection, both of which occurred in persons known to have handled wild game. The principal lesion observed is a conjunctivitis. Clegg,¹ in making an examination of a rabbit that had been found dead on a ranch seven miles southwest of Soledad, Monterey County, found the animal to be infected with the *Bacterium tularensis*.

The Etiology of Cholecystitis. Rosenow,² in a study over a period of two years in different localities, in different seasons of the year and in different species of animals, found that streptococci and colon bacilli from cases of acute cholecystitis gave more marked lesions in the gall-bladders of dogs than did those of chronic cholecystitis. The organism showed a very definite elective affinity for the gall-bladder and in some strains the virulence could be diminished by cultivation, or increased by animal passage without this affinity for the gall-bladder being lost. In the main, however, this affinity was not maintained. The strains grown on artificial media acquired a greater affinity for the stomach and appendix, while those passed through animals acquired an affinity for the pancreas.

¹ Public Health Reports, April 28, 1916, p. 1045.

² Journal of Infectious Diseases, October, 1916, p. 527.

Coccidioidal Granuloma. This rare disease has attracted a certain amount of attention inasmuch as every case on record has come out of the San Joaquin Valley, in California. Of some 40 cases, Dixon states that 35 were residents of the State of California, and in three other instances the patients had visited California. One case has been reported from Buenos Ayres, and now Lipsitz, Lawson, and Fessenden¹ have reported another from Missouri occurring in a negro, aged twenty-eight years. The patient was a single man, a sleeping-car porter, who entered the hospital July 19, 1915. He was able to walk when he entered the hospital. He complained of cough, loss of weight, and general weakness. A tentative diagnosis of pulmonary tuberculosis was made. He was born in Kentucky, lived there until the age of six years, when his family moved to Tennessee. Later he lived in Cairo, Illinois. He moved to St. Louis in 1909. Up to this time he worked as a farmhand and as a hotel porter, but since 1909 had been a porter on the Missouri Pacific Railroad, running between St. Louis and Denver but he had never been in California. His illness started three weeks before his entrance to the hospital. The patient thought he had a cold, with coryza, hoarseness, and cough. A few days later he felt better but his cough and hoarseness persisted, and a profuse, frothy sputum made its appearance. He lost about 10 pounds in three weeks and felt feverish in the evenings. The first of August the patient noticed nodules in the calves of his legs, one of which was found in each calf. They were slightly tender, hard, and about the size of hazel nuts. After this new nodules appeared every day. Some were subcutaneous and some in the muscles, and were distributed over the thighs, legs, front of the chest, abdomen and forearms, varying in size from that of a pea to a hickory nut. In attempting to remove one of the nodules from the pectoral muscles, it was punctured and was found to be an abscess containing a bloody, slightly opaque fluid. This fluid contained many leukocytes and some round bodies. At this time there was dulness on percussion over the lungs, the right middle and lower lobes posteriorly, bronchovesicular breathing and subcrepitant rales, the lung picture suggesting bronchopneumonia. The patient grew rapidly worse and died fifty-two days after the onset of the disease.

Klenk made a bacteriological examination of the nodules, and cultures were made in glycerin and plain agar and in bouillon, and were grown at 30° C. In twenty-four hours a profuse, homogeneous, grayish-white growth almost completely covered the solid medium, and as the cultures became older, aërial hyphæ were apparent at the edges. Under the microscope, mycelial threads, with club-shaped ends, were seen. After about a week, flaky globular bodies about the size of a small cherry, and covered with fine villus-like projections were seen at the bottom of the fluid cultures. This was regrown and injected into a guinea-pig.

¹ Journal of the American Medical Association, April 29, 1916, p. 1365.

The findings were the same as those described by Ophüls and Wolbach, whose article appeared in the *Journal of Experimental Medicine* in 1904. This case was one of the most rapidly progressive of those reported, and the coccidioidal granuloma seems to be rapidly more fatal than systemic blastomycosis. Most of the cases have had an irregular temperature and a moderate leukocyte count, but in this particular instance the leukocyte count was quite marked, varying between 12,000 to 32,400 and there was a high continuous temperature. It is highly probable that cases of this disease are overlooked and supposed to be tuberculosis.

The Etiology of Common Colds. I have referred from time to time to what is known as the common cold and to the various organisms that have been described as the cause of this affection. These include the *Bacillus influenza*, *Streptococcus hemolyticus*, *Streptococcus viridans*, the pneumococcus, *Micrococcus catarrhalis*, Tunncliffe's *Bacillus rhinitis*. A couple of years ago Kruse suggested that while common colds are undoubtedly infectious, yet the small number of bacteria in the secretions and the short time that these organisms persist is against the view that they are concerned in the infection. He succeeded in producing colds experimentally with a filtrate from the nasal secretion of an assistant who was ill with coryza. This was diluted 15 times with normal salt solution, and, after passing through a small Berkefeld filter, it was found that a few drops of the filtrate placed on the mucous membrane of the nose caused acute coryza in one-third of the individuals upon whom the observation was made. The incubation varied from one to four days. The first experiment was carried out on 12 individuals and the second on 36 students, of whom 42 per cent. developed a cold. It was impossible to demonstrate any organisms in the filtrate, and Kruse suggested that the organisms should be classed with the filterable viruses.

Foster,¹ has succeeded in confirming these observations, and has succeeded in growing the virus, using methods similar to those used by Noguchi in growing organisms of rabies in poliomyelitis. The material was obtained from the nasal secretion of one of the staff who had been ill with an acute cold for two days. A second lot of material came from a typical cold in the head in the author, and a third from an employee in one of the large department stores. The typical signs and symptoms of coryza were present and at the time the specimen was taken the individual was free from fever, except in the last case there was a possibility of there having been a slight temperature the evening before.

In addition to the cultures made from the original specimens, cultures were also made from the individuals in whom the coryza had been produced experimentally. Under the dark-field microscope, myriads of extremely active, minute bodies were seen, occurring singly, in pairs, and in groups of various size. They were so active that no definite idea of

¹ Journal of the American Medical Association, April 15, 1916, p. 1180.

their morphology could be formed, but the movement appeared to be true motility rather than Brownian movements. Stained smears from cultures showed no bodies that could be recognized as microorganisms, although minute coccoid bodies and occasional rod-like forms were seen, they were not in sufficient numbers to preclude the possibility that they were artefacts. Eleven men were inoculated with the filtrate from the subcultures, and after a period of forty-eight hours all the men became ill with acute colds. In 5 of these experimental cases, the secretions were collected, and the cultures made from them showed the characteristic appearance.

Duodenal Ulcer in Infancy an Infectious Disease. The subject of duodenal ulcers in infants has been receiving a considerable amount of attention of recent years. In 1909 Helmholtz¹ collected a large series of cases reported from various clinics. In 1913 Holt² was able to find 91 cases in the literature and added 4 more from his own clinic. The etiology of the ulcers has been a matter that has not received, until recently, very much attention. Holt noted that 3 of his 4 cases were observed within a period of three months. Helmholtz called attention to 12 cases which occurred during the last four months of 1908, at the Berliner Kinder Asyl. During the first months of 1908, and the entire year of 1909, there were no other cases. During the period of seven months from September to April, Gerdine and Helmholtz³ observed 11 cases in one hospital, the only ones that have ever been noted at the Children's Memorial Hospital. The grouping of the cases suggested very strongly that the condition was of infectious origin.

In this connection the work of Rosenow⁴ is of very considerable interest. Rosenow's article contains a rather extensive bibliography of experimental and other ulcerations of the stomach and duodenum. He isolated a staphylococcus, certain yeasts, and the *Bacillus subtilis*, but these organisms he considered as accidental invaders of the ulcers, inasmuch as he was unable to produce ulcers in the stomachs of animals used for observation. Streptococci, having a characteristic affinity for the stomach and the duodenum, have been repeatedly isolated by Rosenow from various infections in patients with ulcer and from the ulcers themselves. They tend to disappear from the circulation and do not usually produce marked lesions otherwise. These organisms have been isolated from ulcers in animals and the ulcers been reproduced on their reinjection. The filtrates of these cultures, however, show no tendency to cause any lesions. Rosenow believes that the usual ulcers of the stomach and duodenum are due to a localized, hematogenous infection of the mucous membrane by streptococci.

¹ Deutsch. med. Wehnschr., 1909, i, 534.

² American Journal of Diseases of Children, 1913, vi, 381.

³ Ibid., December, 1915, p. 397.

⁴ Journal of Infectious Diseases, September, 1916, p. 333.

These observations, and others that have been made within recent years, probably stimulate the study of this subject which may result in a more thorough understanding of the disease. The relation between ulcers found in adults and in infants will have to be considered in this connection.

Dysentery. THE TREATMENT OF AMEBIC DYSENTERY. Two years ago Nixon¹ suggested the use of *chaparro amargosa* as a substitute for *emetine* in amebic dysentery. More recently he² has reported a case of the disease which had for five months resisted the *emetine* treatment. This patient was then treated with *chaparro amargosa*, and, while the results were not so immediate as in other cases, the disease was controlled by the use of the drug.

The plant is a small, thorny bush indigenous to southwest Texas and northern Mexico. It grows to two or three feet in height and produces a small red berry about the size of a pea. All parts of the plant possess a characteristic bitter taste and is supposed to have medicinal properties. The drug is generally on the market as a fluidextract, the dose being 1 to 3 drams given before meals, but Nixon and others have used an infusion made by boiling roots, branches, foliage and fruit, in water for thirty to sixty minutes. The infusion so made is the color of moderately weak tea. The patient should be kept in bed, and the diet restricted to liquid or semiliquid articles. An ounce of magnesium sulphate is given three or four hours before treatment is begun and repeated every three or four days. From six to eight ounces of the infusion are given by mouth about one-half hour before each meal, and a rectal enema of from 500 to 2000 c.c. of the infusion are given, the patient being placed in the knee-chest position for the injection.

The results obtained in his first series of 12 cases of undoubted amebic dysentery of three or four years' standing, were as follows: 10 were given the *chaparro amargosa* infusion and 2 the detannated fluidextract; there was immediate cessation of the symptoms in all cases; one case disappeared from observation after three months; one case had been well for ten weeks, one for three months, two for one year, one for two years, and five for more than two years; there was one recurrence in a case insufficiently treated; in only one case was a living ameba found in the stools after the treatment was begun; these cases averaged less than two days before the stools became normal; there were no liver abscesses or other complications; experimental data prove the amebicidal action of *chaparro amargosa* no less surely than do the clinical results, the drug undoubtedly having an elective affinity for the protoplasm of *Entameba histolytica*.

¹ Journal of the American Medical Association, May 16, 1914, p. 1530; American Journal of Tropical Diseases and Preventive Medicine, 1915, ii, 572.

² Journal of the American Medical Association, March 25, 1916, p. 946.

THE TREATMENT OF CARRIERS OF AMEBIC DYSENTERY. Dale¹ believes that even large doses of emetine hydrochloride, such as the full course of 10 to 12 grains, does not always free ameba carriers of the parasites. He believes that there are some cases in which there is a temporary absence of the cysts from the feces, but that many of these relapse into cyst-passing again, sometimes even after repeated treatments with emetine. He has used, in these cases, a double iodide of emetine and bismuth. It is practically insoluble in dilute acids, but soluble in weak alkali. It passes through the stomach unaltered, being dissolved in the alkaline juices of the small intestine, with the gradual liberation of emetine and the precipitation of bismuth sulphide. This substance was suggested by Du Mez, and was tried by him upon dogs. Dale first tried the drug on cats, and subsequently on 10 patients, 6 of whom were discharged as cured after having failed to show any cysts during six weeks of daily examination. Two of these cases had been previously treated with emetine hypodermically and were not passing any cysts when the treatment was begun. The seventh case relapsed after a full course of the double iodide, but, after a second course, was freed from the cysts at the time of the report. The other cases were hopeful, but 1 case has relapsed after two full courses of treatment, and the other 2 were unable to take the treatment fully on account of the nausea which the drug occasionally produces. The daily dose was from 2 to 4 grains, given in capsules, 3 grains representing 1 grain of emetine hydrochloride, and 12 such doses being regarded as a full course of the treatment, unless it produces giddiness, diarrhea, depression, or frequent vomiting.

STUDIES ON DYSENTERY VACCINE. Everyone recognizes the desirability of having some means of treating, and also preventing, infections with the dysentery bacillus. For various reasons the vaccines that have been made are unsatisfactory, owing to the toxicity of the dysentery bacillus and the pain following the subcutaneous inoculations. Petruschky believes that, by making an ointment of the killed dysentery bacilli, good results may be obtained by inunctions, but he had very little experimental evidence at the time of his report. Thomson² made some studies of various kinds of dysentery vaccines in rabbits. His conclusion was that rabbits are not a suitable animal for the study and comparison of dead Shiga vaccines. He also determined that heating should be avoided in the preparation of vaccines, inasmuch as it does not reduce their toxicity and it destroys the antigen that calls forth the complement body. Unheated carbolyzed vaccines he found to give better immunity than any other. The degree of immunity obtained with vaccines sensitized by serum and with untreated vaccines was apparently about the same in degree, but whether one or the other is more lasting was not determined. There was some little difference in the symptoms after the

¹ *Lancet*, July 29, 1916, p. 183.

² *British Medical Journal*, February 26, 1916, p. 303.

administration of the serum, and there was less loss of weight in the animals that were inoculated with serum vaccines than with the other forms. The whole subject is one of extreme difficulty, yet it seems highly probable that these difficulties may be overcome by subsequent experimentation.

Castellani¹ found, as have other observers, that bouillon cultures killed by heat gave extremely severe local and general reactions, so that persons may be incapacitated for more than two weeks after such an inoculation. He determined that a vaccine prepared with the Shiga-Kruse bacillus does not give immunity for forms of dysentery due to the Flexner-like, and other dysentery germs. He believes that the vaccine should be prepared with carbolic salt emulsion with agar cultures without heating, or other cultures may be made from peptone-water cultures, but in no instance should bouillon cultures be used. It is very desirable that the dysentery vaccine should contain several species of the dysentery bacteria and not be made from only one strain. He believes that vaccines should be made from organisms that are not virulent, or very little so, but at the same time rich in antigen. These may be tested by inoculating rabbits. One difficulty is that strains of this nature of the Shiga-Kruse bacillus are encountered with extreme rareness. The vaccines which he has been using in Ceylon are standardized as follows:

Shiga-Kruse bacillus, 1,000,000.

Flexner bacillus, 1,000,000.

Hiss Y bacillus, 1,000,000.

Flexner-like No. 1, 1,000,000.

Flexner-like No. 2, 1,000,000.

These vaccines were mixed in equal parts so that 1 cm. of the mixed vaccine will contain 125,000,000 of each of the organisms used. Of these vaccines, 0.5 c.c. is given hypodermically the first time, and the same amount after a week. The reaction is not very severe, though more marked, as a rule, than the typhoid-paratyphoid vaccine. Agglutinins generally develop for all the germs of the dysentery group which have been injected, but their amount is not high, the agglutination limit seldom being higher than 1 in 40, and is somewhat inconstant and irregular, but the same may be said of individuals inoculated with simple mono-vaccines, Shiga-Kruse, Flexner, etc. He has also suggested the use of this vaccine combined with typhoid, paratyphoid, paratyphoid A, and paratyphoid B, the preparation being made from twenty-four-hour agar cultures in normal salt solution to which 0.5 per cent. of phenol has been added. The vaccines are as follows:

Typhoid bacillus, 4,000,000.

Paratyphoid A bacillus, 1,000,000.

Paratyphoid B bacillus, 1,000,000.

¹ British Medical Journal, February 26, 1916, p. 306.

Shiga-Kruse bacillus, 1,000,000.

Flexner bacillus, 1,000,000.

Hiss Y bacillus, 1,000,000.

Flexner-like bacillus No. 1, 1,000,000.

Flexner-like bacillus No. 2, 1,000,000.

These vaccines are mixed in equal parts so that 1 c.c. of the mixed vaccine will contain 200,000,000 of the typhoid bacillus and 125,000,000 of each of the other organisms used. Of this, 0.5 to 0.6 c.c. is administered for the first dose and the same, or double the amount, one week later. The reaction is, as a rule, more severe than after the typhoid-paratyphoid vaccine, and the agglutination limit seldom is higher than 1 in 40 and is somewhat irregular and inconstant, the typhoid, paratyphoid A and paratyphoid B agglutinins, on the other hand, are produced in fair amount, though as a rule distinctly less than in persons inoculated with simple typhoid, paratyphoid A and paratyphoid B vaccines.

DYSENTERY CARRIERS have been a vexing problem, particularly in their relation to the armies in Europe.

Karell and Lucksh¹ have suggested the use of vaccines in the treatment of these individuals, and have applied this method to cases of typhoid and also dysentery carriers. Unfortunately, in summarizing their work they have not separated the dysentery and typhoid cases. In 42 cases, however, in which the individuals treated were carriers of one or the other, they succeeded in relieving the condition of 35. All these cases were of long standing and in a few instances in which the treatment was resisted, in place of using homologous vaccines, heterologous vaccines were used, they believe, with good effect.

THE ETIOLOGY OF DYSENTERIC DIARRHEA. Of recent years there has been considerable attention paid to the various parasites in the intestine that were formerly regarded as more or less harmless. There is, however, a growing tendency to place more weight upon the various flagellate protozoa. Rhamy and Metts,² have reported a local epidemic of trichomonas dysentery. During seventeen years of laboratory experience, Rhamy has never found these parasites except in cases with acute or chronic diarrhea, and he has become convinced that these parasites are more of importance as etiological factors in diarrhea than was formerly believed. The *Trichomonas intestinalis* is a pear-shaped organism about 17 microns long by 10 wide, with 4 or more flagella which it uses for locomotion, and it moves in a quick, jerky manner. They live best in natural or slightly alkaline mediums and may be found in any tissue of low vitality, but their usual habitat is the gastrointestinal tract. Rhamy and Metts made the definite diagnosis of trichomonad infection in a case of acute dysentery in 1907. In 1909

¹ Wiener klinische Wochenschrift, February 17, 1916, p. 187.

² Journal of the American Medical Association, April 15, 1916, p. 1190.

there was an epidemic of dysentery in Wells County, Indiana, in which there were 78 cases of dysentery with 17 deaths.

Diphtheria. THE CONTROL OF DIPHTHERIA. Everyone who has had much to do with diphtheria and the laboratory investigations, especially with reference to isolation, has been struck with the discrepancies between the clinical findings and the results of cultures. These discrepancies would probably not be so great if in each case the bacillus was tested for its virulence, but, with the present methods, that is almost impossible and certainly so with the average health department. Most of the health departments lay more stress on the bacteriological findings than on the clinical picture, the usual method of procedure being to make cultures from all contacts and convalescents, and to isolate those showing the presence of the diphtheria bacillus until negative cultures are obtained, and some health departments test the virulence when the organism shows an undue persistence. Lewis,¹ epidemiologist for the Board of Health in New Haven, Connecticut, has given a brief summary of two years' practical experience, both as a bacteriologist and as an epidemiologist. In the first year's campaign, he followed substantially the prevalent practice, but in the course of the year he found reason to regard the inspection of the nasal pharynx as less misleading than the information provided from cultures, as not a single case of diphtheria could be traced to patients from whom the pharyngeal culture gave a negative result. He believes that the carriers may be divided into two groups, the pharyngeal and the nasal. The pharyngeal type represents about one-quarter of the cases and shows an acute hyperemia superimposed upon a chronic pharyngeal hypertrophy. There is a history of an attack of diphtheria when the culture is positive. The nasal type shows a bloody, purulent anterior nasal discharge, usually only on one side, with excoriation of the upper lip and surrounding skin. The nasal type may be divided into two classes, in one of which there is a history of an attack of diphtheria with frequent nosebleeds in the course of the disease or during convalescence. A characteristic discharge develops after a few weeks, or occasionally after a few months. In the second class the patient presents the lesion without having had the disease. The nasal type is found most frequently in children under ten years of age, and, while they have not had the disease, they have generally been infected by nasal carriers or other children in their family who have had it. The nasal carrier who has not already had the disease does not develop pharyngeal diphtheria. Lewis states that the seasonal prevalence in carriers coincides with that of coryza. He believes that three-quarters of all the diphtheria carriers may be picked out by an inspection of the nose and throat. In the second year of his work he gave less prominence to the study of cultures and more to the conditions

¹ Journal of the American Medical Association, May 13, 1916, p. 1535.

of the patient. If the nasopharynx was normal, the individual was not isolated, even though a positive culture was found, and where the nasopharynx was normal the quarantine was raised. When the exposed individual showed an acute pharyngeal hyperemia, the individual was isolated and kept under observation. Under the new rule there were no return cases and no carriers developed as a result of the procedure. On the other hand, two new infections were traced to a case in which the pharynx was yet mildly inflamed, but on which the quarantine had been raised on account of two negative cultures. The person in question proved to be a pharyngeal carrier. Especial search was made for missed cases and carriers by investigating all absentees from school and all children in school with nasal discharges, their names and addresses being furnished by postal card notification through the school-teacher. In the first year some 5000 cultures were made, while in the second year only one-third of that number was taken, but the number of inspections was doubled. Lewis believes that two other precautionary measures should be taken. One is the systemic recurring inspection by field nurses of children under school age in families with no school absentees, and the second is the notification to the Board of Health of families moving into the city.

DIPHTHERIA CARRIERS. A large number of various methods of treatment of diphtheria carriers have been advocated. Ruh, Miller, and Perkins,¹ have suggested the removal of the tonsils. They regard that a true carrier is an individual that harbors *virulent* diphtheria bacilli in, or upon, the tissues for a period of twenty-one days or more. Among the various methods that have been suggested to get rid of the bacillus are biological products, chemical substances, and mechanical methods. Neither antitoxin or toxin mixtures have any value in this connection. Vaccines have been suggested by Petruschky, who incidentally has used vaccines for almost everything else, and in some instances with remarkable results. In regard to diphtheria, his work needs further investigation before its value can be definitely decided one way or the other.

Hewlett and Nankivell suggested the use of a vaccine made from the endotoxin which also needs confirmation by other observers.

DIPHTHERIA BACILLI IN THE TONSILS OF DIPHTHERIA CARRIERS. Following the suggestion that certain persistent diphtheria carriers gave negative cultures after tonsillectomy and the removal of the adenoid, Brown² became interested in the studies of the sections of tonsils of diphtheria carriers. Seven specimens were studied, six of whom had had pharyngeal diphtheria, and one was a carrier without symptoms. All had had positive cultures from nose or throat for twenty-one days or over. The tonsils from 14 other cases were studied as controls. Of the 7 diphtheria carriers, 6 yielded Gram-positive, beaded bacilli in

¹ Journal of the American Medical Association, March 25, 1916, p. 941

² Journal of Infectious Diseases, October, 1916, p. 565.

great number. These organisms, together with large and small streptococci and diplococci, were found in the crypts and also in the tissues lining the crypts. In one case which showed no Gram-positive bacilli, 50 sections were studied from the tonsils and 50 from the adenoids, and in this case continued to give positive cultures for four days and from the nose for nineteen days after tonsillectomy, but in this case the bacteria were probably multiplying in some other place. Of the 14 control cases, only 2 showed any Gram-positive bacilli and these may have been diphtheria bacilli. Keitly,¹ in studying diphtheria in normal throats, found that the incidence of carriers in adults is from 0 to 2 per cent., and in children from 0 to 25 per cent.

Last year Hektoen and Rappaport called attention to the use of *kaolin* in the treatment of diphtheria carriers. This substance has remarkable absorptive power as well as being an antiseptic, and it was suggested some years ago as a means of treating intestinal infections. In a more recent contribution, Rappaport² has reported the results of 100 unselected patients, 96 being diphtheria patients, and 4 being diphtheria carriers. These latter were persons who had the diphtheria bacilli in the nose or throat, but who had no history of sore throat or other symptoms of diphtheria, and who gave a negative Schick reaction. Before using, the kaolin should be finely powdered, breaking up the lumps and passing it through a fine flour sieve. This is then dried for several days in an ordinary bacteriological incubator or any suitable dry heat. If the kaolin becomes moist, it should be dried out before use in order to get good results. It should be applied very finely powdered and perfectly dry. The powder may be sprayed into the nose and throat by use of a powder blower, and it may be applied to the throat by allowing the patient to swallow a half-teaspoonful of the dry powder. The powder should be applied about six times a day which practically means at intervals of about two hours. The powder sticks to the mucous membrane and so prevents the fresh powder from acting, and this should be removed by a mild alkaline spray and solution of sodium bicarbonate and sodium baborate, 2 per cent. of each being very satisfactory for this purpose.

Rappaport compared the 100 patients treated with the 100 patients that were untreated. The average stay in the hospital of the treated was 25.61 days, and of the untreated cases 33.45 days. The average days in the hospital was 7.84 days less than that of the untreated patients, or a shortening of 23.4 per cent.

One carrier presented a point of especial interest. In this case diphtheria bacilli had been present in the nose for two months before treatment, and there was some mucopurulent discharge from the right nostril. After eight days' application of kaolin with no improvement,

¹ New York Medical Record, 1915, lxxxviii, p. 311.

² Journal of the American Medical Association, March 25, 1916, p. 943.

examination revealed a shoe button rather firmly imbedded high in the right nostril. Two days after the removal of the button the nose was free from bacilli that a few days before had been virulent for guinea-pigs. The button had evidently favored the presence of the bacilli, most likely by protecting them from being taken up by the kaolin.

Ott and Roy¹ have suggested the use of *iodized phenol* of the *National Formulary*. This contains 60 per cent. phenol, 20 per cent. iodine crystals, and 20 per cent. glycerin. In pharyngeal cases the tonsils, uvula and posterior wall of the pharynx were swabbed every forty-eight hours until negative cultures were obtained. In nasal cases the anterior part of the nasal cavity was swabbed with iodized phenol every forty-eight hours. Care should be taken not to allow the preparation to run over the face or drop into the larynx.

DIPHTHERIA IN THE FIRST YEAR OF LIFE. The great rarity of diphtheria in infants under one year of age lends great interest to an article by Rolleston.² The exact percentage of children under one year of age attacked with diphtheria varies in various parts of the world and the experience of different observers. In Rolleston's series of 2600 diphtheria patients of all ages, the morbidity in the children under one year of age averaged 45 per cent., as compared with 7.3 per cent. in the total. Twenty patients out of 2600 were in the first year of life, 7 in the first six months, the youngest child being five weeks old, and 13 in the second half of the first year. In 67 cases, lesions were limited to the nose, and this gives a percentage of 30 as compared with 1.5 per cent. of the total cases. In 8 cases there were multiple lesions, in 15 per cent. of the cases there were cutaneous lesions, whereas in the total number of cases the skin was 1.1 per cent. In only 3 of the cases could the source of infection be definitely determined. In the 9 cases that died, 5 of the deaths were caused by bronchopneumonia, 2 by cardiac paralysis, and 2 from congenital syphilis. The antitoxin was used in relatively large doses, the patients with mild attacks receiving from 1000 to 4000 units, those with moderate attacks from 8000 to 12,000 units, and those with severe attacks from 12,000 to 24,000 units at a single injection which was in some cases repeated. Rolleston believes that congenital syphilis is an important predisposing cause.

SCHICK REACTION. The New York City Department of Health distributes a diphtheria toxin together with the necessary salt-solution and apparatus for its use. The toxin is relatively stable if kept on ice, and this may be used even after it has been kept for a year. At room temperature the toxin deteriorates, and after it has been diluted with the salt solution it decomposes rapidly, so that it is not advisable to use it after twelve hours, and it is much better to use it just after it has been

¹ Journal of the American Medical Association, March 11, 1916, p. 800.

² American Journal of Diseases of Children, July, 1916, p. 47.

mixed. Zingher¹ states that in a series of 800 children who gave a negative reaction to the Schick test, although a considerable number had been exposed to diphtheria, not a single child developed the disease. There appears to be little doubt that a negative reaction means immunity to diphtheria, while a positive reaction indicates a probably susceptibility.

The duration of immunity after the usual dose of diphtheria antitoxin has been studied, and, after the usual 1000 units, it was found that the first dose gave an immunity for from fourteen to twenty-one days, while the second dose protected only from seven to ten days. In those naturally immune, this immunizing dose produced greater immunity.

The active immunity produced by the toxin antitoxin mixtures does not develop immediately or soon enough to give immediate protection in the wards where the subject has been exposed to the disease. This method of producing immunity sounds very favorable and greater familiarity with it will probably yield very satisfactory results.

Koplik and Unger² have suggested a variation from the technic heretofore used in making the test. They have devised a needle which simplifies the technic. The skin on the forearm is cleansed with alcohol, the latter is encircled by the thumb and index finger, and the skin held tense between them. The needle is dipped into the bottle of pure, undiluted toxin and then immediately inserted intradermally. It is, of course, important that the needle be inserted intradermally and not subcutaneously. This is an ordinary hypodermic needle bent at a distance of one-quarter of an inch from its point so as to make an angle of about 170 degrees. From the place of bending to the distal end it is shielded so that only the unshielded one-quarter of an inch can be inserted into the skin. It is so constructed that when it is inserted its full length the amount of toxin carried in is approximately one-fiftieth of the minimal lethal dose. They have had the needle weighed before and after using, and the difference was found to be 0.0001 gm., which was the ultimate possibility of weighing on the scales used. The advantages of this test are its simplicity, the saving in toxin which does not have to be diluted, and it also, according to its authors, reduces the pseudoreactions to a minimum. In all their cases the technic described was used on the left arm, while the Schick technic was used on the right arm. In every instance in which the reaction was positive by the Schick technic, it was positive by the Koplik-Unger technic, and the negative cases by one were also negative by the other. The traumatic pseudoreactions which appear to be positive by the Schick technic, although really negative were found to be negative by this simplified method. Of the anaphylactic pseudopositive reactions, which appear to be

¹ *Pediatrics*, March, 1916.

² *Journal of the American Medical Association*, April 15, 1916, p. 1195.

positive by the Schick reaction, though really negative, 75 per cent. were eliminated.

Anyone interested in the Schick reaction who is not entirely familiar with the procedure will do well to read an article by Zingher.¹ He not only goes over the technic, but gives a very good description of the reactions, together with two plates that are most instructive and which show very well the different types of reaction that occur. His conclusions are the result of testing 2700 normal children.

Zingher² has contributed another article dealing with some work done with the Schick reaction on *scarlet fever patients exposed to diphtheria*. Zingher believes that the test is absolutely reliable in showing the presence or absence of antitoxin immunity to diphtheria, and that a negative reaction means protection probably indefinitely against the disease. This is particularly illustrated in the fact that 656 scarlet fever cases with a negative reaction, even though constantly exposed to infection during periods of from four to eight weeks, did not develop the disease in spite of the fact that 15 per cent. of them had purulent diphtheria germs at one time or another in their throats.

The test has another value in determining *the efficiency of active immunization* of susceptible individuals who have been injected with a mixture of diphtheria toxin and antitoxin. Only cases with a positive Schick reaction should be chosen for such tests, and they may be tested at intervals of from one, three, six, and twelve months, to see whether there has been a production of active immunity. The test may also be used to clear up the diagnosis clinically in doubtful cases. Thus, a patient with a purulent or bloody nasal discharge, showing the diphtheria bacillus, may be tested to see whether the case is a carrier or a beginning diphtheria. If the patient shows a negative reaction, it means that he is a carrier, and if it shows a positive reaction it suggests the probability of it being the beginning of the disease. Similarly, a case of tonsillitis due to a streptococcus in which the presence of diphtheria bacilli would, by a negative reaction, show that he was merely a diphtheria carrier, but in no danger from the diphtheria poison. A study of the test has also shown the advantage of very early treatment with antitoxin. A delay of a day, or hours even, may make a very marked difference in the ultimate outcome, and very toxic cases should be treated with very early intravenous administrations of large doses of antitoxin. If the patient has gone through an attack of diphtheria, the test may be used to find whether he has become immune to a second attack. The test is, of course, of great use in saving diphtheria antitoxin in the case of hospital and institutional epidemics, and also in families. Individuals showing a negative reaction, even though intimately exposed to the disease, need not be immunized.

¹ American Journal of Diseases of Children, April, 1916, p. 269.

² New York State Journal of Medicine, March, 1916, p. 118.

The Pseudoreaction in the Schick Test and its Control. Another important piece of work has come from the Research Laboratory of the Health Department of the City of New York and deals with this subject. Zingher,¹ in making the Schick test, refers to the pseudoreactions which may cause some little difficulty. These pseudoreactions are not caused by the soluble diphtheria toxin, but by the protein which is present in the solution used for the test. These pseudoreactions are comparatively infrequent in children, and are most frequently noticed in women and individuals who have enough natural antitoxin to render them immune to diphtheria.

In an individual who gave a positive reaction only, the control test with the heated toxin will be negative. In one who gave a pseudoreaction, the control reaction will be of about the same size and appearance, and pass through the same clinical course as the original reaction, *e. g.*, the two reactions showing a similar central area of redness of varying size, surrounded by a secondary areola which shades off into the surrounding skin. Both reactions begin to appear in about six to eighteen hours, reach their height in twenty-four to thirty-six hours, and disappears in three or four days, leaving a poorly defined area of pigmentation and generally no scaling.

In an individual who gave a combined reaction in the original test, both the positive and the pseudoreaction may be detected. The positive reaction becomes manifest in the original test at the end of from three to four days, when the pseudo-element of the reaction has disappeared, as a definite circumscribed area of redness, which measures from 1 to 2.5 cm. in diameter and shows superficial scaling, with beginning brownish pigmentation. The pseudoreaction is detected in the control test with the heated toxin; the reaction will not be as marked as in the original Schick test, but passes through the typical clinical course of a false reaction.

An Anaphylactic Skin Reaction to Diphtheria Bacilli. Along the same line as the above is the work of Kolmer and Moshage,² who have made a study of this subject, which has a certain practical bearing in relation to the pseudo-Schick reaction.

The Schick Test in its Relation to Repeated Intradermal Injections of Diphtheria Toxin. Cowie³ has made an interesting study of this subject. The injections of the toxin were made with a small needle intracutaneously just beneath the epidermis. Eighty-one persons, taken at random with ages ranging from two days to adult life, showed that 50 reacted positively and 31 negatively. Of the 50 cases reacting positively, the first evidence of a definite reaction was observed on the first day in 21 cases; on the second day in 13 cases; on the third day in 8

¹ Journal of the American Medical Association, May 20, 1916, p. 1617.

² American Journal of Diseases of Children, September, 1916, p. 316.

³ Ibid., p. 266.

cases; and on the fourth day in 8 cases. The reaction was noted in 23 per cent. of the cases under five months, in 83 per cent. from five to twelve months, in 87 per cent. from one to five years, in 52 per cent. from six to twelve years, and in 77 per cent. of adults. Regarding the two-zone reaction, he believes that while such a reaction may occur with dilute diphtheria toxin, it is very frequently the result of the action of the toxin itself and seems to depend either on the concentration or upon the individual tolerance. He believes also that the statement that the margin of lesion must be well-defined is not true, as this depends largely on the strength of the solution and the susceptibility of the individual. Although the typical lesion in a test is followed by characteristic desquamation in a distinctly susceptible person; in less susceptible persons only yellowish or brownish rash appears, and this may vanish very quickly. Cowie had many cases in succession in which no scaling whatever was encountered. The size of the reaction is influenced by the strength of the solution. Reactions obtained with 1 to 20,000 and 1 to 10,000 solutions are the same, while those with stronger solutions are very much greater in size. The intensity of the reaction is also very much influenced by the strength of the toxin itself, and no two lots are necessarily the same, so that reactions made with the same dilutions of different toxins may vary somewhat in size. The intensity of the reactions, which seems to be indicated by the degree of redness and edema, as well as by the size of the lesion, also depends on the strength of the solution employed and the susceptibility of the person. There is no person the intensity of whose lesion cannot be varied at will by the choice of the solution used. On the other hand, only those who possess little or no immunity react to the standard Schick solution with marked edema and induration. The influence of the time of the year on the reaction is most interesting. Some years ago Brown pointed out the fact that the susceptibility of animals to diphtheria was influenced by the season, the guinea-pig, for example, being more susceptible in winter than in summer. It is also well-known that diphtheria is more prevalent during certain seasons of the year, the greatest number occurring during the cool or cold months. The collection of a number of Schick tests in which the season in which the test was made is known, show that a negative result will be encountered oftener in warm summer months than in winter. Cowie believes that successive intradermal injections of very dilute solutions of diphtheria toxin, when given at intervals varying from five to twelve days, provoke the formation of antibodies, and in those cases already exhibiting a certain degree of immunity, bring about a definite degree of immunity as recognized by the intradermal test. The degree of natural immunity may be judged by the time, appearance, and character of the primary intradermal reaction. The early primary reaction of ordinary degree indicates an absence or low degree of immunity, while a primary reaction appearing

late shows that such a person has a greater degree of immunity than one who reacts early. The development of the immunity produced by very small successive doses of toxin is generally recognized by a hastening in the time of the appearance of the reaction and a diminishing of the size of the lesion. In those cases in which the intensity and size of the reaction was reduced by successive injections of the toxin, the time of the appearance of the reaction was hastened in a large majority of cases, the greatest change occurring in those which gave a primary reaction on the third or fourth day. If the character of the reaction does not change after the second, third or fourth intradermal injection, the case may be considered one without any reacting bodies, and one in which diphtheria could be necessarily easily induced. The degree of immunity induced by these small doses seems to be very slight, and cannot be compared with the results obtained by toxin-antitoxin solutions. Solutions containing sufficient toxin to induce immunity when given intradermally are not well borne by the patient.

Pulmonary Distomiasis. This disease, which is caused by the *Paragonimus westermanii*, Kerbert or the human lung distome, is one which may be met with in the United States, particularly if we have more commerce with the Orient. It was first described in 1879 in the lungs of individuals in Formosa. Since that time it has been found in Japan and elsewhere. Nakagawa¹ has made a rather extensive study of this subject. When he began his observations about all that was known of the life-history of this organism was that Nakagawa and Manson had found that the miracidia hatched from the eggs began to swim in about four weeks from the time of entering the water after they come out of the patients.

Nakagawa found the larvæ of the *Paragonimus westermanii* in certain species of crabs known as red crabs (*Potamon obtusipes*), and, by using the liver, gills and other organs of these crabs, he was able to infect young dogs. In order to ascertain how the distome found its way into the final host examination was made on puppies at various intervals after infection. Without going into detail of his observations, which anyone interested may find in his article, it may be stated that the encysted larvæ that have been taken into the alimentary canal of the host escape from the cysts and make their way through the intestinal wall near the jejunum into the abdominal cavity. They then penetrate the diaphragm and reach the thoracic cavity, scattering over the pleura whence they easily find their way into the lung. They pierce the lung parenchyma and there the cysts are formed until they become fully grown. These parasites can bore their way through various tissues until they reach the lung, which seems to be the most favorable place for their development and the laying of their eggs; in the other organs they can never reach their perfect growth.

¹ Journal of Infectious Diseases, February, 1916, p. 131.

The Prognostic Value of Blood Cultures in Erysipelas. Sprunt¹ has made a study in a series of cases and found a streptococcus bacteriemia in 5 out of 34. Of these 5, 4 died, while the fifth had very few organisms in the blood and no other complication and recovered after a prolonged fever of thirty-two days. There was one other fatal case in which blood cultures were not made, but in which metastatic lesions suggested that a bacteriemia existed. In the patients whose blood was sterile, there was no death, although several complications were encountered, such as suppuration, phlebitis, and erysipelas migrans.

These observations are somewhat at variance with the ordinary teaching that bacteriemia in erysipelas is rare, but this is perhaps easily explained by the fact that the technic of making blood cultures at the present time is far superior to the methods employed a few years ago. Sprunt suggests the use of routine blood cultures in all cases of erysipelas, and in severe cases, where one culture is negative, a subsequent one should be made.

Foot-and-mouth Disease. Curiously enough, the epidemic of foot-and-mouth disease of last year has not been followed by any particularly striking contributions to our knowledge of the subject. There is an excellent account of the disease, with the report of a case, by Clough,² and his article is illustrated by several beautiful plates by Max Brödel, showing the eruption on the hand, the appearance of the tongue and lips, and the desquamation on the skin of the feet. He also gives a résumé of what is known about the subject, with the reference from which the information had been gleaned. He concludes with the remark that the clinical picture presented was that of a mild febrile infectious disease, characterized by the appearance of an erythema and a superficial vesicular eruption over the mucous membrane of the mouth, and the skin of the hands and feet; by salivation; by swelling, burning and paresthesias of the affected parts with subsequent desquamation; by healing of the ulcers without scar formation.

The examination of the blood is not without interest. Hemoglobin, 95 per cent., with the white blood cells 10,000, and the differential count on the sixth day of the disease as follows:

Neutrophiles	73 per cent.
Eosinophiles	1 "
Basophiles	1 "
Small mononuclears	12 "
Large mononuclears	9 "
Transitionals	3 "
Unclassified	1 "

The patient was twenty years of age.

Sutton and O'Donnell³ have also reported a case in a farmer, aged

¹ Johns Hopkins Hospital Bulletin, October, 1916, p. 300.

² Ibid., October, 1915, p. 351.

³ Journal of American Medical Association, March 25, 1916, p. 947.

twenty-five years, and their article is illustrated with several plates, but not in colors.

Cosco and Aguzzi¹ have made some observations on the occurrence of virus of the disease in the blood. Their studies were made on 116 cattle, and it was found that the blood was virulent during the entire course of the fever, quite as much so as the material taken from the eruption. Both the red corpuscles and serum contained the virus, and the defibrinated blood retained its virulence for over a month when kept at nearly freezing temperature. They were able to reproduce the disease in cattle by subcutaneous injection of either red blood corpuscles or the serum. They feel hopeful that a vaccine may be made by using the red corpuscles.

Immunity in Hodgkin's Disease. I have noted at several different times in recent years, in the March number of *PROGRESSIVE MEDICINE*, the progress in the study of Hodgkin's disease, and Bunting and others believe that the disease is due to a diphtheroid organism, which may be called the *Bacterium hodgkini*. Moore² has made a number of studies dealing with the immunity of the disease, and is convinced that horses can be immunized by repeated intravenous injections of the bacilli isolated from the lymph nodes in Hodgkin's disease. Soluble toxins were not formed, however, when these organisms were grown in glucose broth, and vaccination with them did not appear to increase the complement-binding antibodies in the patients. The complement-fixation tests of the sera of these patients were negative, except in 1 instance in which positive Wassermanns were repeatedly obtained. Agglutination experiments with the sera of two patients were likewise negative, and complement-fixation tests of cases of lymphosarcoma, lymphatic leukemia, chronic arthritis, and tuberculosis, diseases in which the diphtheroid organisms have been isolated, all reacted negatively with the antigens used.

These results would seem to throw a very considerable doubt on the subject of the causation of Hodgkin's disease and still further studies on this subject should be undertaken.

The Treatment of Kala-azar by Tartar Emetic Intravenously and by Inunctions of Metallic Antimony. Last year I made a brief note on the use of tartar emetic in kala-azar. Early in 1915 Leonard Rogers commenced the use of tartar emetic intravenously in India. This observation was made independent of any worker, although he subsequently learned that Cristana and Caronia had previously given it successfully in the African form in Sicily. Rogers and Hume³ report certain cases treated with this drug, and in these cases the blood and material from splenic puncture was studied. They began with only 0.5 to 1 c.c. of a

¹ *Il Policlinico*, April 30, 1916, p. 549.

² *Journal of Infectious Diseases*, 1916, xviii, p. 569.

³ *British Medical Journal*, February 26, 1916, p. 301.

2 per cent. solution and rapidly increased it to 3 or 4 c.c., and repeated the injection every three days, adding 1 c.c. to it at each injection up to the maximum of 10 c.c. if the patient had no gastric disturbances. If this developed, the dose was somewhat reduced. They have had no serious symptoms, although they have given as large a dose as 20 cg. The technic of the injections is very simple. A 10 c.c. syringe is used, a prominent vein selected, and the injection made after the manner of intravenous injections, great care being used that the fluid enters the vein and not the skin around it, as the tartar emetic is very irritating and a few minims injected under the skin causes great pain where the injection is made and it comes in contact with the tissues, and, later on, a hard, painful swelling develops, and even sloughing of the tissues may occur in some cases. They report 6 cases treated by the intravenous method. Three had completely recovered at the time of the report, two were very much improved, and, considering the progress in the previous cases, they expect a complete recovery. One died of pulmonary tuberculosis, the kala-azar having been apparently cured. The cases were all typical ones, and the Leishman-Donovan parasites were found in the material removed by splenic puncture. The blood examinations in these cases showed the usual ratio of red blood corpuscles to white, the white being very much reduced in every case, and the ratio varying from 1 to 1830, 1 to 2631, 1 to 2174, etc. Under the treatment, the general health improved, the temperature became normal, the patient gained in weight, and the ratio of red to white cells returned to normal. Rogers had already suggested and reported results from the *inunction* of finely divided *metallic antimony* in lanolin. His first report was made in the *Indian Medical Gazette*, July, 1915, p. 273. This method has great advantage in cases of children who have small veins, and in two cases in which the lanolin was used there were apparently successful results. The strength used was 10 per cent. As a sample history, the case of a European girl, fifteen years of age, is given. The kala-azar in this case was of a year's duration, with intermittent fever and enlargement of the spleen for six inches below the ribs. She was fairly well nourished, and was a comparatively favorable case for treatment, the spleen puncture showing the Leishman-Donovan parasites. One ounce of antimony ointment was rubbed in over the abdominal wall every third day. At the end of five weeks her temperature was normal, she had gained twelve pounds in weight, her general condition greatly improved, and the spleen had also decreased in size. She continued the treatment after she left the hospital, and there was good promise of her complete recovery.

These observations are of extreme interest, as heretofore kala-azar has baffled all attempts to treat it successfully and it is possible that antimony will be found useful in other forms of infections that resist the usual methods of treatment.

Malaria. MERCURIC CHLORIDE IN MALARIA. There are certain cases of malaria which resist quinine treatment. Various methods have been suggested for the treatment of these individuals, among others the use of mercuric chloride. Barlow¹ has made an analysis of 100 cases treated by this method. The first part of his article deals with the prophylaxis of malaria, the second part chiefly with the use of mercuric chloride in the treatment of the disease. He used a solution of mercuric chloride in normal salt solution of such a strength that 10 c.c. of the solution represented one-eighth grain of the mercuric chloride. The arm was disinfected with iodine which was washed off with alcohol to avoid any possible formation of mercuric iodide. Out of the 100 cases, 31 left the plantation too soon after the cessation of the treatment for the records to be of value. When there was but a small number of parasites in the blood, the mercury usually brought about a complete sterilization at the first injection, and this result was obtained in some cases when there were as many as three parasites in the field. With much higher infections, the fever was reduced, sometimes disappeared and returned later, and sometimes after a reduction again rose, but not to the point which it had reached previous to the injection. Ill-effects were seen in very few cases, and were slight. Diarrhea was observed in 11 cases, but was not severe and rarely persisted more than one day. Slight salivation occurred in 1 case, and slight albuminuria was noted in another. In 3 or 4 cases, there was phlebitis at the point of injection but with a sharp, small needle this was not apt to occur.

THE CONTROL OF MALARIA. A very good example of what may be accomplished in this work is given in a report about Roanoke, North Carolina, by von Ezdorf.² The town is small and is situated near water courses and woods, with a mosquito-breeding season extending from about May to October or November. The disease is extremely prevalent and the local health officers believe that 75 per cent. of the people in the town had malaria during the summer of 1910, and that during 1911, 1912, and 1913 its prevalence was as great. After carrying out the work of reclaiming the mosquito-breeding areas, a large number of the inhabitants were again examined in October, 1914, after the work had been in progress over a year, and it was then found that about 4.5 per cent. of the inhabitants had malaria. This amount of reduction in one year would be about 67.7 per cent. In October, 1915, the examination of nearly 1000 inhabitants living in the area of the antimalaria operations showed that 3.51 per cent. had the disease, whereas another group living outside the area were examined and 20 per cent. were found to be infected.

¹ American Journal of Tropical Diseases and Preventive Medicine, April and May, 1916, pp. 545 and 581.

² Public Health Reports, March 10, 1916, p. 614.

THE CONTROL OF MOSQUITOES. Derivaux¹ investigated the relation of the whirligig beetles (*Dineutes*) and the destruction of the larvæ of the *Anopheles* mosquito. It has been stated that the *Anopheles* larvæ are destroyed by this beetle which is a small, dark, oval, flat insect frequently seen in more or less still water floating on the surface or performing gyrations. It was found that, when beetles were placed in receptacles containing clear water in which there were *Anopheles* larvæ, they consumed large numbers of these larvæ. However, when the surface of the water was covered with fragments of light débris, the larvæ were not eaten, evidently either from difficulty in locating them or in securing them after they were located. The inference seems to be that the beetles are a factor in destroying mosquito larvæ in clear and more or less still water.

Measles. **ETHYLHYDROCUPREIN IN MEASLES.** In **PROGRESSIVE MEDICINE** for March, 1914, I called attention to the work of Lenné with ethylhydrocuprein in pneumonia. Among other observers, Giemse and Izar believe it to be a specific in cases of estivo-autumnal malaria, and Ginsberg has used it locally with good results in cases of pneumococcus keratitis. Morgenroth has contributed some articles on its use in experimental trypanosome infections, and also in pneumococcus infections, and Vetlesen has made a report on the treatment of some cases of pneumonia.

Hirschfelder and Schultz² have used it in experimental pneumococcus septicemia in mice, but neither they nor Engwer were able to obtain any results in the treatment of pneumococcus infections of guinea-pigs and rabbits. They tested the drug on scarlet fever and measles; in scarlet fever the drug was without any effects whatever, but the measles cases showed certain rather encouraging results. The drug was given by mouth in capsules, from 0.1 to 0.5 gm. three times a day.

The Permanganate Reduction Index of Cerebrospinal Fluid. Last year I commented on some studies made by DuBois and Neal on the subject of meningitis, and this report contained some particularly interesting statements regarding the differential diagnosis between meningitis and the group of cases generally described as meningismus. In adults and older children symptoms of meningitis are very apt to mean acute involvement of the meninges, whereas in very young children the meningeal symptoms may appear in association with almost any other disease and may test even the skill of the experienced clinician. Some years ago Mayerhofer³ suggested the use of a permanganate reduction test made on the same principle as the older one used in water analysis, and he found that the greater the content of organic substances, the greater the reduction of the permanganate solution, so that pathological fluids gave a higher index than normal fluids. The permanganate reduction index, according to this observer, is the amount of decinormal permanganate solution,

¹ Public Health Reports, May 19, 1916, p. 1227.

² American Journal of Diseases of Children, May, 1916, p. 361.

³ Wiener klinische Wochenschrift, 1910, xxiii, 651.

which, boiled for ten minutes in a strongly acid medium, is reduced by 1 c.c. of cerebrospinal fluid. He placed the border-line of normal and pathologica¹ fluids between 2 and 2.3, the normal fluids generally falling below 2.

Hoffmann and Schwartz¹ have used this method in cerebrospinal fluids obtained from patients showing meningeal symptoms. For the most part, their studies were made on fluids that were practically clear, bloody fluids were eliminated, and a few examinations of turbid fluids were made to show the constancy of high index values in such cases. The test was made with a sample of the entire fluid obtained at one lumbar puncture, and they did not determine the index on various portions of the fluid. The titration was done as soon as possible after the puncture had been made, as changes may occur in fluids on standing which lead to erroneous results. A reduction index of over 2.5 in a clear fluid, almost invariably indicated the presence of an actual inflammatory process of the brain or meninges, usually a tuberculous meningitis, but the high index was also found in encephalitis, serous meningitis, and poliomyelitis. In 17 fluids from persons with tuberculous meningitis, 16 had an index above 3, 13 were between 2.5 and 3, whereas one was 2.3. This same case on a subsequent puncture gave an index of 3.1. All these cases could have had the diagnosis made without the test, but the early appearance of the high index was most striking. In these cases there was no definite relationship between the cell counts and the reduction index, many varieties being noted in the various cases. In 8 cases of cerebrospinal fever, the index was above 3 in all but one, which was an index with a clear fluid of 2.4. Two cases of streptococcus meningitis gave indices of 2.7 and 4.8, respectively. In 3 cases of acute poliomyelitis, the readings varied from 2.5 to 3.3 in the acute stage, and showed a decline with the disappearance of acute symptoms. In meningismus, the index was found to give border-line readings in all but one case, and the same is true of cases of encephalitis or other cases associated with hyperemia of the brain. The general value of this test seems to lie in cases in which the index is high in clear fluids. This may be taken to mean that there is an acute inflammatory process, most likely tuberculous meningitis or an acute poliomyelitis.

THE REDUCING SUBSTANCE IN CEREBROSPINAL FLUID. One of the clinical methods in vogue in recent years is to test the cerebrospinal fluid for the reducing substance, the usual test being to use Fehling's solution. There have been a good many contributions made in recent years on this subject, among which may be mentioned an article by Schloss and Schroeder.² They believe that the reducing substance is a fermentable, dextrorotatory sugar, probably dextrose. In 49 cases they made a determination of the percentage present. The fluid in these cases was

¹ Archives of Internal Medicine, February 15, 1916, p. 293.

² American Journal of Diseases of Children, January, 1916, p. 1.

from persons suffering with various diseases. The only point of interest in these observations being 3 instances in which patients were moribund at the time of the examination, the dextrose was very low, while in one it was high. In cases of cerebrospinal fever, they found that the reducing agent is generally greatly decreased, and they were also able to confirm the observations of Connall, who found that the reducing powers increased with the improvement of the patient. In miscellaneous types of meningitis, as pneumococcus meningitis, influenza meningitis, and streptococcic meningitis, the reducing agent was very greatly decreased or absent. Two cases of cerebrospinal syphilis and 6 cases of various types of idiocy were observed, and, in all, the sugar-content was within the normal limits. The chief interest of their observations is in tuberculous meningitis. The results in this disease are inconstant. They found, by making quantitative determinations, that in a single specimen of spinal fluid the dextrose percentage may be normal, slightly reduced, or greatly reduced, and that this variation cannot be definitely traced to any influence. In most of their cases there was a decrease in the sugar value in some stage of the disease, and usually as it progressed. There were two exceptions to this. In one case the sugar was found decreased on the first examination, but at the time of the third it was normal. In one other case the sugar content was normal during the entire course of the disease. In infants and children free from meningeal disease the sugar ranges from 0.05 to 0.134 per cent. (dextrose), approximately the same figures which obtained for blood sugar. In meningismus there is no decrease in the reducing power of the cerebrospinal fluid. A large proportion of the cases of tuberculous meningitis show a decrease in the fluid at some stage of the disease. A decrease only is of any diagnostic significance.

In this connection the work of DuBois and Neal, reviewed last year in *PROGRESSIVE MEDICINE*, is of very great interest. They tried the Fehling solution with 88 known tuberculous fluids, and 65 or 73 per cent. gave a good reduction. This means that while the absence of reduction is of marked significance in the differential diagnosis between tuberculous meningitis and poliomyelitis, the presence of reduction means absolutely nothing. I shall take this opportunity to again recommend this article by DuBois and Neal as one of the clearest accounts of practical points in the examination and diagnosis of the various forms of meningitis that has been published in recent years.

Meningitis. *MENINGITIS IN THE NEWBORN AND INFANTS UNDER THREE MONTHS OF AGE.* Koplik¹ has had an opportunity of studying 9 hospital cases of meningitis and 3 in private practice, occurring either in the newly born or in infants under three months of age. As he states,

¹ *Archives of Pediatrics*, July, 1916.

the disease in the newborn has received but very little attention, and this may be due to the fact that a child of that age does not react to infections in such a way as to call attention to them. The signs of the disease at this period may also be obscured by the child having passed through a severe or difficult labor. There is, in some cases, a caput succedaneum, and often wounds about the head and neck from the forceps. The temperature at this time may be due to slight septic absorption, and may even be accompanied by convulsions, which is apt to add to the difficulties of diagnosis. The child, even with a meningitis, may be perfectly limp, and the rigidity of the neck, the Brudzinsky and the Kernig signs seen later, are absent. The most characteristic symptom of meningitis in the newborn is the presence of convulsions. These may be frequent, repeated at the onset of the disease, and afterward recurring at regular intervals. Koplik states that they are liable to occur two to four days after birth. The temperature with the second convulsions is usually lower than the earlier temperatures, and after the first week may drop to normal and practically keep so during the remainder of the disease. The child cries more or less constantly and is very restless. The internal pressure is not manifest at the beginning and it may be days or weeks after the onset before the fontanelle begins to bulge. The interpretation of MacEwen's sign in the newly born is so exceedingly difficult as to be of little value, owing to the fact that there is more fluid in the cranium in early infancy than later on. In purulent cases the convulsions are accompanied by a falling temperature, and symptoms of collapse and cyanosis resembling chills. There is more or less constant vomiting in the form of a regurgitation and this has no relation to the time of feeding. There may be twitching of the extremities and the child may groan in breathing.

In the 12 cases studied, 4 showed the presence of streptococcus in pure culture, 3 pneumococcus, 4 meningococcus, and 1 the colon bacillus, the last the result of a systemic infection from a pyelitis. The cells found in the fluid were polymorphonuclears and they may be the only organism present. The outlook is, naturally, exceedingly grave. All the streptococcus cases died, as well as the pneumococcus cases. The colon case developed hydrocephalus and died in later infancy. All but one of the meningococcus cases died, the one which recovered had a hydrocephalus following.

MUMPS AND MENINGITIS. One of the most interesting combinations from the stand-point of diagnosis is the symptoms of meningitis supervening in mumps. It is a very well-known fact that during the course of this disease meningismus may be encountered, and some of the French writers, notably Chauffard, Hutinel, and Monod have written considerably about the existence of a true meningitis having its origin in mumps. Dopter described various instances of this condition.

Sainton and Bosquet¹ have reported an instance of a young soldier, nineteen years of age, who entered the hospital with an average case of mumps. From the seventh day of the disease the patient was taken with violent pains in his head, with a rise of temperature, and on the following day he presented the typical appearance of a person with cerebrospinal fever. A number of lumbar punctures showed the fluid to be scarcely turbid, but it was found that the patient was suffering with cerebrospinal fever and he was given an injection of the antimeningitis serum. The fluid showed about an equal number of lymphocytes and polynuclear cells, together with some large mononuclears, and an occasional meningococcus, for the most part extracellular. Subsequently several other doses of serum were administered; in three or four days the symptoms had abated, while the mumps had entirely disappeared. Such a case might easily be mistaken for a meningismus, complicating mumps. This case recalls one reported by Ravaut and Krolunitsky.² Their patient had mumps in which meningeal symptoms appeared as the swelling began to go down. A lumbar puncture showed an increase in the polynuclear cells, with the presence of a diplococcus within the cells. Antimeningitis serum was without appreciable effect, and further studies showed that the organisms had been found and was probably parameningococcus. An injection of the parameningococcus serum resulted in a cure.

These cases show very conclusively that one should not be too hasty in assuming a meningismus with symptoms of meningitis supervening in the course of mumps. The only way to settle the question is by a lumbar puncture.

THE DIAGNOSIS OF ABORTIVE CEREBROSPINAL MENINGITIS. Culpin³ observed a series of cases of meningitis in which a certain number of abortive ones were seen. This type starts with a headache, and the evanescent meningitis is shown by the stiff neck and by Kernig's sign. Lumbar puncture at this stage may reveal a few pus cells and an occasional diplococcus, or the examination of the fluid may be negative. There is a rise in temperature, to which the pulse rate is often unrelated, but in two or three days, or even less, the pulse and temperature become normal and the patient seems well. If the pulse rate is watched carefully, it will be found to drop some time between the second and third day after the onset. The count may be as low as 60 a minute, and often even 50. This slowness of the pulse lasts a variable time, sometimes only being present during two or three takings of the pulse and sometimes lasting as long as a week, with occasional increases. If, during this period, the patient is allowed up he complains of not feeling well, with vague discomfort in the head, and the pulse rate does not increase. In the cases observed by Culpin, this sign was almost invariably present

¹ Bulletin de la Academie de Médecine, October 5, 1915, p. 368.

² Bulletin de la Société médicale des hôpitaux, July 15, 1915, p. 618.

³ British Medical Journal, February 26, 1916, p. 307.

when there were clinical grounds for a diagnosis, even when the lumbar puncture gave a practically clear fluid. It is highly probable that these abortive cases help to spread the disease in times of epidemics, and this sign described by Culpin may be of considerable value in picking out these cases, although if the cerebrospinal fluid is normal, the diagnosis would still remain a matter of doubt.

Mumps. AN EXPERIMENTAL STUDY OF MUMPS. There has been comparatively little work done upon mumps, so that any addition to the scanty literature is very welcome, particularly so when it comes from as careful a worker as Wollstein.¹ The earlier investigations consisted of rather brief bacteriological studies in which certain cocci were isolated from blood, saliva, and from the fluid aspirated from the swollen parotid glands; the chief contributions being those by Laveran and Catrin, by Tessier and Esmein, in France; by Bien and Michaelis, in Germany; by Mecray and Walsh and Darling, in America. The cocci isolated by these observers were not pathogenic for animals, and some observers even failed to find these organisms in cases of mumps. The more recent studies have started at the subject from a new angle. In 1908 Granata suggested that the virus might be filterable, and obtained the saliva from two patients, passed it through a filter and inoculated it into rabbits, injecting some into the blood, some into the parotid glands, and some subcutaneously. A rise of temperature lasting three days followed the intravenous injections, and the other inoculations were followed by a swelling of the parotid glands which lasted one or two weeks. A couple of years ago Gordon² used a filtrate for the intracerebral inoculation of monkeys. He was able to produce a fatal meningitis, a marked increase in the leukocytes and also marked degeneration in the neurons of the cerebral cortex and anterior horns of the cord. Cultures from the meninges were sterile. One animal, inoculated intraperitoneally and intravenously, was taken on the eleventh day with swelling of the parotid and stiffness of the jaws. This animal recovered. The disease could not be transferred from one animal to another by using filtrates of the cord from the fatal case. Nicolle and Conseil³ injected the fluid aspirated from the parotid gland of children ill with mumps into the parotid gland of three monkeys. The animals developed fever lasting two to seven days, and in one of the monkeys the parotid was swollen. No bacteria could be demonstrated in the fluid used in the injection. The animals showed a mononuclear cytolysis in one instance.

Wollstein's work was done with cats, rabbits and monkeys, but most of the work was with cats, inasmuch as the rabbits and monkeys did not show very promising results.

¹ *Journal of Experimental Medicine*, 1916, xxiii, 353.

² Reports to the Local Government Board on Public Health and Medical Subjects, London, 1914, n. s., No. 96.

³ *Compt. rend. Acad. d. sc.*, 1913, clviii, 340.

The observations made by him prove quite conclusively that the saliva from mumps contains a filtrable virus capable of producing very definite pathological changes when inoculated into the testicle and parotid gland of cats. What the nature of this virus is and its exact relation to epidemic parotitis, will have to be determined by further observation. This is, however, the most enlightening piece of work that has been done on this subject.

The Oxyuris and Appendicitis. The question as to whether the oxyuris may cause lesions in the appendix, or not, has been the subject of considerable discussion. A large number of contributions have been made on this, and, in *PROGRESSIVE MEDICINE* for March, 1913, I reviewed the observations that had been made up to that time. There is no question that the oxyuris is found in the appendix in a certain number of cases in which the appendix is the seat of definite disease. Among the questions that have been considered are the frequency with which the oxyuris is found in the appendix, and its part in the production of appendicitis. In Germany, Aschoff believed that this parasite played an unimportant part, and, in a monograph published in 1908 on appendicitis he found only two instances in which the parasite was present out of 1000 appendices examined. On the other hand, Rheindorf has published several papers upon this subject since 1912, in which he states that he believes that this organism plays an important role in the etiology of the disease, especially in children, and that it is far from being the harmless parasite it was formerly held to be. Aschoff subsequently stated that he believed that the oxyuris might cause a disease condition somewhat similar to true appendicitis, and before this he had suggested the term *appendicopathia oxyurica*.

Suzuki¹ has made a contribution to this subject based on a study of the appendices from 500 postmortem cases, of which 44 were oxyuris cases. In these 44 cases the appendices were cut into several sections and studied throughout. In addition to this the appendices from 103 cases of appendicitis were studied in a similar manner. In the 500 post-mortem examinations the oxyuris were found 29 times in the cecum and appendix alone. The various authors that have written on this subject have all agreed that the oxyuris is found in much greater proportion in children than in adults.

Suzuki believes that the destructive effect of the parasite on the epithelium is to be attributed to a mechanical cause. He does not believe that the organism liberates a toxin.

There has been considerable discussion as to *whether the parasite can penetrate an intestinal wall that is entirely normal*. Wagener describes the presence of an oxyuris in the intestinal wall. Schneider has described a dead female oxyuris in the pelvic peritoneum, but he believed that it

¹ Surgery, Gynecology and Obstetrics, December 7, 1915, p. 702.

reached this site by way of the Fallopian tubes. Various observers found the organism in the cervical canal and in the uterus. Suzuki was able to demonstrate one instance in which the head of the worm was found penetrating the mucosa. In the 103 cases of appendicitis, 16 showed the oxyuris, and in 6 of these the organism was found in the mucosa. From the evidence at hand, he believes that the parasites may not only be found in the lumen but in the mucosa and submucosa of the appendix without any noteworthy symptoms or anatomical changes.

Poliomyelitis. This disease has attracted so much attention during the past year that I have made a more extended review of it than of the other subjects. The sources of information are varied and some more or less inaccessible to the general reader. For this reason I have endeavored to answer the questions about the disease that would naturally arise and to give such information as I myself have wanted. The review includes the new publications to the date of writing. There will doubtless be, during the next year, a large flood of papers, the result of studies made during the recent epidemic.

THE NATURE OF THE VIRUS. The virus can be filtered through a Berkefeld filter, which places the disease among those ordinarily classed as being caused by a filterable virus. The virus withstands exposure to light, heat, cold and drying, rather more than did the ordinary bacteria. It will retain its virulence in the height of the summer heat, even when dried on pieces of clothing, and it is not destroyed by the action of ordinary weak chemicals. It withstands glycerination a long time, and is not injured by 0.5 per cent. phenol. It may be frozen at -2° C. to -4° C. for four days without materially affecting it. It is destroyed by heating one-half hour at from 45° to 50° C. It is also destroyed by exposure to sunlight and by the action of 2 per cent. hydrogen peroxide, by menthol solutions, mercuric bichloride, iodine, and, in fact, by any of the stronger disinfectants. Ordinary solutions used in the nose and throat as preventives do not prevent the development of the disease.

The virus obtained from the human body is not particularly infective for monkeys and it has to be used in amounts and under conditions that may be regarded as artificial. There are great variations in the strength of the virus, both as it occurs in human beings and in monkeys. In the human being it is probably most infective during the first week or two of the disease and probably in most instances begins to be attenuated after that time, although it may persist apparently in its full strength over long periods of time. In the monkey the virus tends to become fixed, very much in the same manner that the rabies virus becomes fixed in the dog. There are, however, some samples of virus that cannot be intensified or fixed. When fixed, it becomes extremely virulent, so that only very minute quantities are necessary to infect a second animal. This intensity of the fixed virus remains constant through a long series

of animals, but eventually, as has been shown by Flexner, it loses some of its infective power and in this way resembles the variations seen in different epidemics of the disease in human beings. There are periods in which the disease is epidemic in which the virus seems to be particularly virulent, and after a certain time the virulence seems to change. Just what brings about this change is not at all understood at the present time, but this variation in virulence probably has something to do with the recurrence of epidemics.

Further studies are needed to determine the presence of the relative virulence of the virus as it is found on fomites. The few observations made have merely demonstrated that the virus may be found on objects that have been in intimate contact with patients suffering with the disease. Just how long the virus may be dried under natural conditions before it loses its virulence is at present a matter of question. Römer, Flexner and Lewis, Landsteiner and Levaditi think that this period is several days, whereas Wiener and von Wiesner believe that if the material is allowed to dry slowly, in a small layer, it will become non-virulent in twenty-four hours. The more I see of infectious diseases in general, the less importance I attach to transmission by fomites as a means of spreading disease, and I think this opinion will be borne out by all who have had much practical experience with them.

Many studies have been made on the virus under artificial conditions; for example, Landsteiner and Levaditi, and Pastia,¹ found that the virus lived at ordinary room temperature and light when kept in sterile milk or sterile water.

THE CULTIVATION OF THE VIRUS. In PROGRESSIVE MEDICINE for March, 1914, I have given the details of Noguchi's work done with Flexner in the Rockefeller Institute. He succeeded in producing cultures by using fragments of nervous tissue, preferably from the brain or filtrates of the same. The cultures were made by using the same technic as was used for the cultivation of spirochetæ by the same observer, the details of which need not be repeated here. The organism was described as constantly found in the central nervous system of both human beings and monkeys. The organisms were very small, measuring from 0.15 to 0.3 mikron in diameter. Great difficulties were always experienced in obtaining the initial culture, and, even when grown, it has not always been of sufficient pathogenicity to cause infection in the monkey. From some of the cultures, however, the disease was reproduced in the monkey and caused what was apparently typical poliomyelitis. As far as I know, this work has not been confirmed.

Recent Investigations of the Cultivation of the Virus. Three articles have appeared recently dealing with this subject, the first by Mathers,²

¹ Annales de l'Institut Pasteur, 1911, p. 805.

² Journal of the American Medical Association, September 30, 1916, p. 1019.

the second by E. C. Rosenow, Towne and Wheeler,¹ and the third by Nuzum and Herzog.² All these articles deal with the cultivation of a micrococcus. Mathers used the material from the brain and cord obtained at autopsy under sterile conditions, and as soon after death as possible, and inoculated it into the various mediums, as ascites fluid and ascites-dextrose agar containing a small piece of rabbit kidney, ascites-dextrose broth, and coagulated normal horse serum. The cultures were made both aërobically and anaërobically, and were incubated at 35° C. for from one to seven days. In 7 of 8 cases, after eighteen hours in aërobic cultures, and in from three to seven days in anaërobic cultures, a Gram-positive micrococcus was obtained, and in six of these the organism was in pure culture. Cultures from the heart blood and from the cerebrospinal fluid after death did not show the organism, but it was demonstrated in the mesenteric lymph nodes. It is of low virulence for rabbits, but when injected into the veins in large doses, lesions of the central nervous system are produced, with paralysis, particularly of the extremities. Intracerebral injections into a monkey also caused paralysis. After three or four transfers on artificial mediums, the organism seems to lose its affinity for the nervous system. Further investigations of this are now being undertaken.

Rosenow, Towne and Wheeler made a study of the throats, tonsils, spinal fluid, blood, central nervous system and other tissues, and isolated a peculiar polymorphonuclear streptococcus from the throat and tonsils, and from abscesses in the tonsil in a large series of cases of epidemic poliomyelitis. They also obtained it from the ventricular fluid after death and from the blood in one instance, but not from the spinal fluid. Their organism was apparently the same as that of Mathers.

THE VIRUS IN THE HUMAN BODY. At autopsy the virus may be demonstrated in the tissues and secretions by inoculated emulsions of these into monkeys. The changes produced in the monkeys are characteristic, and the virus may be further transmitted to other monkeys through large series of animals covering long periods of time. The chief locations of the virus in the body are the central nervous system, the brain, spinal cord, cerebrospinal fluid, and the nerves, and it is also found in the lymphatic system, chiefly in the mesenteric nodes. It is also found in the tonsils, and in the nasopharyngeal mucous membrane. It is found less frequently in other tissues, and only exceptionally in the blood. In the living body, in those acutely ill with the disease, it is found in the nasopharyngeal secretions, and in the washings from the rectum. It has been demonstrated in this way in the typical cases, and also in the indefinite and abortive forms. Kling, Wernstedt, and Pettersson and others have demonstrated it in the mucous membrane of the nasal pharynx and rectum in convalescent patients, and it may persist

¹ Journal of the American Medical Association, October 21, 1916, p. 1202.

² Ibid., p. 1205.

for weeks or even months. Persons associated with cases of the disease, especially in times of epidemics, may also have the virus in the nasal pharynx or intestinal tract without ever having had any symptoms of the disease.

THE VIRUS OUTSIDE THE BODY. Numerous studies have been made on this subject, and it has been demonstrated by Neustaedter and Thro,¹ in the dust of rooms that had been occupied by three different cases. It has also been demonstrated on handkerchiefs, and embroidery work that have been about the patient, but comparatively few observations have been made upon this subject. The virus has also been studied outside the human body under artificial conditions, of which more later.

THE LENGTH OF TIME THE VIRUS PERSISTS. In the bodies of monkeys the virus is found to disappear from the central nervous system in from three to six weeks, but it remains in the mucous membrane of the nose and throat and apparently also in the intestine. In man, the virus apparently grows rapidly weaker after the first eight to fourteen days, and in most instances has disappeared completely, or almost so, after a period of three to four weeks, but it may persist much longer and has been demonstrated in the secretions of the mouth for six months after the onset of the disease.

For ordinary purposes of isolation, from six to eight weeks would seem to be sufficient, but this will permit a certain number of individuals to go about with a more or less attenuated virus still present.

THE TRANSMISSION TO ANIMALS. The only animal that may be satisfactorily inoculated at the present time is the monkey, although rabbits under certain conditions, as given below, seem to be subject to the disease, and possibly, exceptionally, guinea-pigs. Up to the present time it has not been possible to produce the disease in any of the other animals that have been used for observations, including dogs, cats, horses, goats, sheep, and some of the other familiar small animals.

The Virus in Monkeys. The disease may be transmitted by injecting the virus into the brain, subdural spaces, or the nerves, into the peritoneal cavity, and less easily by injecting it subcutaneously, and much less so by injecting it into the general circulation. It may also be transferred by rubbing it into the scarified or healthy pharyngeal mucous membrane. It may also be transmitted by way of the stomach or intestines, but only by using massive doses of the virus. The virus for experimental purposes usually consisted of emulsions of the various tissues mentioned, either used as such or after filtration through a Berkefeld filter.

The disease in the monkey is typical, though not quite identical, with that seen in human beings. The experimental work done upon monkeys seems to point to the fact that the disease may be transmitted

¹ New York Medical Journal, September 23, 1911, p. 613; October 21, 1911, p. 813.

under natural conditions through the nasopharynx or through the digestive tract. This question of transmission will be considered under the subheading

Virus in the Guinea-pig. Whether or not guinea-pigs are susceptible to the disease is a matter of some question. Römer and Joseph were unable to transfer the virus from monkeys to guinea-pigs, but they observed that guinea-pigs kept in the laboratory occasionally died from a paralytic disease, and Römer, studying this, found that it was apparently due to a filterable virus. More recently Neustaedter¹ claims to have transferred the virus from a guinea-pig to another guinea-pig and back again to a monkey, the guinea-pig having presumably been infected in the first instance through contact with a monkey with the disease. Rosenau and Havens inoculated a few guinea-pigs, and those that died showed lesions somewhat like the ones they described in rabbits. They do not consider that their observations are sufficiently advanced at this time to draw conclusions.

The Virus in Rabbits. There have been various statements made concerning the susceptibility of rabbits to the virus of this disease. Krause and Meinicke,² in 1909, were the first to pass the virus obtained from a human being through seven generations in rabbits, and the following year Lentz and Huntemüller³ were able to produce the disease by using the virus from one rabbit to another by several methods of inoculation, but the lesions in the brain and spinal cord were not as marked as those found in monkeys. Various other observers, as Römer and Joseph,⁴ Landsteiner and Levaditi,⁵ Leiner and von Wiesner,⁶ and Flexner and Lewis,⁷ were all unable to transfer the disease to rabbits. Marks,⁸ using virus from a monkey, passed the disease through seven generations of young rabbits. Those that died had convulsions, but did not develop any paralysis. He could not find any definite lesions which were characteristic of poliomyelitis on microscopic examination, and he further stated that it was not possible to transfer all strains of virus successfully to rabbits. Rosenau and Havens,⁹ using the virus from a monkey, succeeded in passing the disease through eight generations of rabbits, and at the time of the report the virus shows no signs of dying out, and indeed it seemed to be becoming more pathogenic with each successive passage.

THE VIRUS IN INSECTS. The seasonal occurrence of the disease and the difficulty of explaining certain facts in the epidemiology of the dis-

¹ Journal of the American Medical Association, 1913, lx, 982.

² Deutsch. med. Wchnschr., 1909, xxxv, 1825.

³ Ztschr. f. Hyg. u. Infektionskrankh., 1910, lxvi, 481.

⁴ München. med. Wchnschr., 1910, lvii, 2685.

⁵ Compt. rend. soc. de biol., 1909, lxvii, 787.

⁶ Wien. klin. Wchnschr., 1909, xxii, 1698.

⁷ Journal of Experimental Medicine, 1910, xii, 227.

⁸ Ibid., 1911, xiv, 116.

⁹ Ibid., 1916, xxiii, 461.

ease has suggested that the disease might be transmitted by insects, and at one time it was thought that the ordinary biting stable fly, *Stomoxys calcitrans*, might be responsible for the transmission of the disease. The experiments of Rosenau along this line have not been confirmed by other observers and it seems quite certain that the disease is not harbored in the bodies of flies, nor indeed, as far as we know at the present time, by any of the ordinary insects found about cases. It seems highly probable, however, that the ordinary fly might be a factor in acting as passive carriers of the virus, as Flexner and Lewis, and other observers, have found that a fly soiled with the virus remains a source from which the virus may be recovered for at least forty-eight hours in certain instances. One can readily understand how a fly soiled with the nasal secretions of a sick child might transfer the disease by crawling over the face of a well child, and until the insect methods of transmission are better understood, flies should be rigidly excluded from the sick rooms of cases of poliomyelitis.

EPIDEMIOLOGY. The disease has been studied in the sporadic cases for many years in the various countries of Europe and in America. The first American epidemic on record occurred in 1841, and is described by Colmer. This was of small extent, some 8 or 10 cases occurring in Louisiana. In Norway there was a small epidemic noted in 1868, and in Sweden the first epidemic was apparently in 1881. Since that time epidemics have become more and more frequent, and, since the big epidemic of 1905, the disease has been reported in more or less devastating epidemics throughout Europe, the United States, and even in the West Indies, South America, Australia, and the South Sea Islands. In Europe it extends from Scandinavia to the Mediterranean, and from the British Isles at least to the Danube, and perhaps much farther. The disease is endemic throughout these areas, a certain number of cases occurring every year in practically every State and every large city, and this has been true for many years, although not very much attention has been paid to the disease by health departments until very recently. All of the earlier epidemics were apparently small and scattered, and at the time did not attract very much attention. The spread of epidemics is a most curious phenomenon, distribution being exceedingly irregular. In a general way the spread is along the lines of human travel. A focus starts, and the disease spreads to the surrounding towns and country. Each new case may, or may not, become a focus from which the disease may again radiate. But this extension is singularly irregular. It may spread from one side of a town or the suburbs and not to the other. Many intervening places may escape. For example, there was a small epidemic, in 1910, in Washington, a somewhat smaller epidemic the same year in Philadelphia. Baltimore, between these two, showed only a slight increase in the number of cases, in spite of the tremendous intercourse between these cities. The second feature

very often noted is the rapidity with which the disease spreads over large areas. This was seen particularly in the epidemic in Iowa in 1910, and the epidemic so well described by Wickman in Sweden in 1905, and the subsequent epidemic in 1911, reported by Kling. The disease was epidemic in New York in 1907, and spread north into New England, but did not spread south to Philadelphia or to any of the other cities. The more recent epidemics of 1908, 1909, and 1910, in Minnesota, Nebraska, Iowa, and Kansas were supposed to follow the New York epidemic, but there was no epidemic in Chicago, with which there is a great deal more connection than the places mentioned. Today the means of rapid communication by means of trains, trolleys, and automobiles makes it much more difficult to follow the routes by which diseases are spread, but the fact remains that man is the most rapid of all the travelling animals that carry his diseases, so that it seems highly probable that he is responsible for the spread of poliomyelitis.

An idea has grown up along with the study of the disease that poliomyelitis is a very much commoner disease than we ordinarily think it, that in addition to the frankly paralyzed cases and the now firmly established abortive cases, there are other totally unrecognized forms of the disease. These probably occur either with, or without, symptoms, and, if it affects adults in this unrecognized form, the explanation of the spread of the disease becomes easy. The total number of the population affected in any epidemic is small and this has given rise to the theory of the general immunity of the public to the disease, and it is highly probable that this immunity has been acquired through their having had the disease in some mild, unrecognized form. The fact that it is difficult to recognize clinically in its atypical forms is well known to those of us who have had considerable experience in dealing with the disease. The fact is particularly obvious.

The spontaneous decline of epidemics and the subsequent immunity of the locality, while the disease becomes epidemic in contiguous territory suggests that the disease flourishes as long as it finds suitable soil. When this is exhausted, it spreads to some other fresh territory or dies out.

The view of a *general immunity* is also supported by the fact that adults living in cities are apparently more immune than those living in the rural communities. The tremendous intercourse in cities affords greater opportunities for infection than does life in the country.

The number of people affected in the total population varies greatly in different epidemics. In the larger communities the variations are generally from 1 case to 1000 of the population, to 1 or 2 in 4000. In some epidemics over 1 per cent. of the total population has been affected, but in these instances the epidemics have occurred in small communities.

The *age incidence* has already been noted. The disease occurs chiefly in the young. In the average population children under five make up

from 9 to 12 per cent. of the total population, but in an epidemic of poliomyelitis they average from 50 to 90 per cent. of the cases of the disease. It occasionally happens in some epidemics that children from five to fifteen may furnish a pretty large proportion of the cases.

The *seasonal prevalence* of the disease is marked. The disease may occur at any month of the year, but, both for sporadic and epidemic cases, there is a marked preference for the late summer and early autumn, with the least incidence in winter and spring. Wickman, however, has reported an epidemic in Sweden lasting through the winter, with its maximum in April and May, but winter and spring seem to be the exception. In the southern hemisphere the disease occurs in the same season corresponding to those in the northern hemisphere, but naturally in different months of the year. The disease also seems to have a somewhat greater preference for dry weather. The seasonal prevalence of the other contagious diseases varies. One sees pertussis with its highest incidence in late spring and early summer, almost coinciding to the diarrheal curve. Diseases due to stomach and intestinal infections are more common in summer and early fall, diarrheal diseases and typhoid fever being examples. The respiratory infections are more common in winter, with the exception of pertussis and diseases in which the infection is due to direct contact, such as measles and smallpox, which are more common in winter than at any other time of the year.

The disease rarely spreads in hospital wards to non-affected patients, nor does it seem to affect doctors and nurses. In the homes the infection is not apt to affect many of the family in the frankly paralytic form; thus, out of 2070 persons exposed by residents in the same house with a case of poliomyelitis, only 14, or 0.6 per cent., developed the disease in a frankly paralytic form. I believe that studies of the future epidemics will show that two or more cases in families is much more frequent than is ordinarily suspected, inasmuch as in many instances the disease may be of the abortive form and escape diagnosis. (See the New York epidemic.) In the recent small epidemic in Baltimore I saw 1 instance in which 5 children in one family were affected, but only one severely so, and another family of 3 cases, which I saw through the courtesy of a medical friend, 2 of which had certainly escaped diagnosis had it not been for the third, and the third case would probably not have been recognized had it not occurred in the practice of an unusually skilful physician. I am sure these instances could be multiplied greatly in every epidemic. In a small epidemic in the town of Stötboken, off the coast of Sweden, Kling and Levaditi found that, owing to the small number of people there, it was possible to trace the probable transference of the disease from case to case. This is, as far as I know, the only epidemic of this kind reported, but it is seldom that circumstances are met with that the intermingling of people is not too great to trace the spread of a disease. I have seen several instances this summer of

children who were placed in strict isolation in a suburban place owing to the fear of their contracting the disease, and in 1 instance I found 12 adults present, mostly visitors for the day, and the mother carefully explained that they were remaining out on the farm in order to keep the child away from any possible contagion; and 1 instance in which 2 cases occurred in a small community of only a few families, all of whom were striving to avoid the disease, and yet there was the usual going and coming of servants, tradesmen, and social visitors, any of whom might have acted as carriers.

The statement has often been made that the disease has the same incidence in the well-to-do as in the poorer classes where the hygienic surroundings are not so good. This statement I do not believe to be true, certainly not in my own experience; the larger proportion of cases have come from people in the poorer circumstances. So much more to-do is made over a case in a prominent family that one gets an erroneous impression. The disease is, in all probability, spread through direct contact or by carriers. It has been suggested that these may be divided into two groups, like cases of cerebrospinal fever: the first consisting of temporary transient cases which comprises a very large group; and second, the permanent or carriers over a long period of time, and these are represented by a small group. This has not been worked out as yet, but is an interesting idea.

The disease does not bear any *relation to the paralytic diseases in animals* as far as it is known at the present time. The paralytic diseases of animals are from man, most of them are of the polyneuritic type. They have been very considerably studied and no one has been able to bring them into relation to poliomyelitis. In spite of many efforts to establish the fact that the disease was carried by *insects*, particularly by the stable fly, *Stomoxys calcitrans*, there is no evidence to show that any insect acts as an active carrier of the disease. It has been shown that flies contaminated with the virus may have the virus on them as long as forty-eight hours after the exposure. Thus it would seem that the fly might act as a passive carrier of the disease.

The fact that lesions have been noted in the intestinal tract has led to the suggestion that the disease may be spread by food. There is, so far as I know, however, no direct evidence that this is so. Naturally the food to be suspected is milk, first because we know that it carries other diseases in certain circumstances; second, because we know that in sterile milk the virus will live for a long while; and third, that milk forms a large part of the diet of the population most frequently affected. While this is true, a study of the milk supplies in almost all of the large epidemics in which it has been taken into consideration, does not reveal any relationship of the disease and milk. Wickman, in one small epidemic found circumstances which suggested that milk might have been responsible for the spread of the disease. This observation, so far as

I know, stands practically alone, and Wickman himself does not place any too great credit upon it.

THE RAT AND POLIOMYELITIS. Richardson¹ does not believe that poliomyelitis is transferred from person to person by direct or indirect contact, but that in some manner insects play an important role in the epidemiology. He presents his ideas in two categories: first, the arguments which militate against transferring the disease from person to person by direct or indirect contact; and second, the part played by rats or other rodents and by insects on the rats or rodents, or by both in combination. The chief arguments against the transfer by direct or indirect human contact which he gives are the facts that the virus most closely resembles that of rabies, which is essentially an animal disease. The virus of rabies is widely disseminated through the body and is present in the saliva, and yet the disease is not transferred from individual to individual except through the agency of a punctured wound. The seasonal incidence of poliomyelitis and the maximum prevalence of the disease in country districts, and the failure to spread in hospitals and in schools and institutions, he also points out as against the direct human contact theory. The extreme rarity of the disease in doctors and nurses and the entire absence of infection of laboratory workers, the comparatively rare occurrence of more than 1 case of the disease in one family, even under the markedly congested conditions of tenement life, and that epidemics often cease before the human material has been exhausted, and when the opportunities for direct or indirect contact are at their maximum. He also brings out curious points regarding the spread of the disease, particularly that the diseases has been noted to travel radially from the centers of infection, and it is very common to find the later cases on the outskirts of the infected area, whereas, if a third person or indirect contact were responsible for the spread of the disease, we should expect to have an irregular distribution and to find early as well as late cases on the periphery.

Supporting the theory that the disease is transferred by rodents, by insects, or both, he gives a summary index of the disease and the exclusion of other animal or insect carriers. The relation of the rat to the disease was first called to his attention in 1910 through an observation made by Dr. Charles E. Simpson, Director of Health. He calls attention to the migratory habits of rats, particularly the studies of Creel,² whose work I reviewed in *PROGRESSIVE MEDICINE* last year. He also adds a note to the effect that Rosenau told him that he had been able to produce a paralytic disease in rats by inoculation with the virus of poliomyelitis, but that the experimental data are not sufficiently advanced to draw any definite conclusions. He assumes the transfer

¹ Boston Medical and Surgical Journal, September 21, 1916, p. 397.

² *PROGRESSIVE MEDICINE*, March, 1916, p. 201.

of the disease from rat to man through the agency of the flea. He also calls attention to the possibility of food contamination.

THE NEW YORK EPIDEMIC. The largest epidemic of the disease occurring in the past year was in New York City and the surrounding area. The health department decided to attempt the experiment of isolating all cases as far as possible in hospitals, and thus afforded unusual opportunities for physicians to study the disease. Up until the third of October¹ the number of cases in the city were as follows:

	Cases.	Deaths.
Manhattan	2512	658
Bronx	633	149
Brooklyn	4512	1125
Queens	1121	319
Richmond	285	57
	<hr/> 9063	<hr/> 2308

DEATHS FROM POLIOMYELITIS BY DAY OF DISEASE.

Total deaths to August 31	1962
Under investigation	114

Total included in this study . . . 1848

Deaths on		Deaths on	
1st day	55	8th day	67
2nd day	179	9th day	41
3rd day	315	10th day	36
4th day	369	11th day	28
5th day	300	12th day	16
6th day	182	13th day	15
7th day	110	14th day	8
	<hr/>		<hr/>
Total for first week	1510	Total in second week	211

Deaths on		
15th day	11	} (3+%)
16th day	15	
17th day	8	
18th day	6	
19th day	5	
20th day	10	
21st day	5	
	<hr/>	
Total in third week	60	} (3+%)
After 21st day	67	

¹ Weekly Bulletin of the Department of Health of the City of New York, October 7, 1916, p. 321.

The number of cases occurring in one family is always a matter of very great interest, and the analysis of 7000 cases¹ showed the following:

	Families.	Cases.	Per cent. of total families.
1 case in a family	6521	6521	96.63
2 cases in a family	205	410	3.04
3 cases in a family	20	60	.3
4 cases in a family	1	4	.014
5 cases in a family	1	5	.014
	<hr/> 6748	<hr/> 7000	<hr/> 99.998

The above figures do not indicate the number of children in each family, but studies are being made along this line and further publications will doubtless give more valuable information on this very interesting subject.

One of the lessons learned from the epidemic in New York was the value of publicity and education. The educational campaign in New York was thoroughly done through the newspapers, by distribution of literature, and so on, and the result was that an unusual degree of care was taken of all children as regards cleanliness, food, and all other precautions. The result was that there has been a saving of infant life in New York City sufficient to offset the number of deaths from infantile paralysis. During the first thirty-five weeks of 1916, out of every 1000 infants born, 95 died, while during the first thirty-five weeks of 1915, out of every 1000 infants born, 105 died. The infant death-rate is a fair estimate of the sanitary conditions prevailing in a community, and this lowering in New York is attributed to the effect of education which resulted from the poliomyelitis epidemic.

The age, sex, and nativity in poliomyelitis have been studied in the deaths occurring in New York City from January 1, 1916, to July 1, 1916, inclusive. This table is as follows:

	Manhattan. Both sexes.		The Bronx. Both sexes.		Brooklyn. Both sexes.		Queens. Both sexes.		Richmond. Both sexes.		N. Y. City. Both sexes.	
	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.	M.	F.
Total, all ages	128		33		559		94		34		848	
Total by sexes	74	54	19	14	336	223	55	39	23	11	507	341
Under 1 year	15	10	3	5	47	34	8	5	2	1	75	55
1 year	15	14	..	3	94	46	13	6	4	..	126	69
2 years	18	10	2	3	65	45	10	6	3	5	98	69
3 years	10	5	5	2	43	33	11	8	4	..	73	48
4 years	4	2	2	..	30	20	8	2	3	1	47	25
Total under 5 years	62	41	12	13	279	178	50	27	16	7	419	266
5 to 9 years	11	11	7	..	48	39	4	8	6	2	76	60
10 to 14 years . . . . .	..	..	..	..	7	5	1	3	1	..	9	8
15 to 19 years . . . . .	..	1	..	1	..	1	..	..	..	..	..	3
20 to 24 years	1	..	..	..	..	..	..	..	..	..	1	..
25 to 29 years . . . . .	..	..	..	..	2	..	..	1	..	1	2	2
30 to 34 years . . . . .	..	1	..	..	..	..	..	..	..	1	..	2
35 years and over:												
Colored . . . . .	..	..	..	1	2	2	..	..	..	..	2	3

¹ Weekly Bulletin of the Department of Health of the City of New York, September 16, 1916, p. 297.

What influence, if any, is played by nativity, may be studied from the following table which shows the nativity of the parents of the 848 fatal cases above mentioned:

Both parents born in United States	253
Both parents born in Italy	177
Both parents born in Russia	115
Both parents born in Ireland	40
Both parents born in Austria-Hungary	39
Both parents born in Germany	23
Both parents born in other foreign countries	120
<hr/>	
Total foreign	514
Mixed native and foreign	81
<hr/>	
Total	848

THE INCUBATION PERIOD. The incubation period in the experimental disease as produced in monkeys varies from two days to over six weeks, but usually they develop the disease within two days to two weeks. The incubation period in the human being is usually short, generally under eight days. It has been variously asserted by various observers. Wickman places it at from one to four days, Müller at from five to ten days, with an average of about a week, whereas, Flexner puts it at from two days to two weeks, or occasionally longer.

CLINICAL CLASSIFICATION. The classification of the frank cases of poliomyelitis has been a matter of a considerable amount of study. The scheme suggested by Wickman is, I believe, for ordinary clinical purposes, the best.

No classification of this disease is perfect, and Wickman's gives more help to the average clinician than the other classifications that have been suggested. It may not be out of place to recall that he divides the cases as follows:

1. Spinal poliomyelitis form. Sudden onset followed by paralysis.
2. The ascending form (Landry's paralysis). Involvement of respiratory centers. Most fatal cases belong to this type.
3. The bulbar or pontine form. Nerves most often involves: Facial ocular, hypoglossal. It may exist alone with paralysis of the extremities.
4. Encephalitic or cerebral form. It may exist alone or with spinal involvement.
5. The ataxic form. This is much like Friedreich's ataxia.
6. Polyneuritic form.
7. Meningitic form.
8. Abortive form: (1) General infection; (2) symptoms of meningeal irritation; (3) cases of much pain, like influenza; (4) cases with marked digestive disturbances.

Peabody, Draper and Douchez suggested the same classification,

and the first and abortive, or non-paralytic form, were presented by cases which showed no paralysis at any time; second, a cerebral group embracing involvements of the upper motor neuron with a resulting spastic paralysis. These are the cases to which Strümpell gave special attention about 1885; and third, a bulbar spinal group presenting lesions of the lower motor neuron with flaccid paralysis. While this may be more scientific and better suited to highly trained workers, it is not as graphic as Wickman's and for that reason not as suitable for ordinary clinical work as done by the average practitioner.

The Abortive Form. Wickman, in his marvelous monograph, divides the abortive cases into four classes:

1. Those with the course of a general infection.
2. Those showing meningeal irritation.
3. Those with marked pains suggesting an influenza.

4. Those with accompanying gastro-intestinal disturbances. To this one might add a fifth for the purpose of calling attention to it, of an anginal form or those beginning with definite sore throat. It should be borne in mind that poliomyelitis is a disease, which, probably in a very large proportion of cases, does not involve the nervous system to such an extent as to cause special symptoms, and the cases characterized as abortive are merely those which go through a preparalytic stage without having any definite paralysis following. If this point is borne in mind, it simplifies the conception and also the description of these cases, for what is true of the abortive cases is equally true of the preparalytic stage of the ordinary form of the disease. Doubtless a great number of the so-called abortive cases have muscular weakness or even paralysis of a very limited amount. It is extremely difficult to detect even marked difference in muscular power in very young infants, so that the lesser degrees of loss of power may easily escape notice, even after the most searching and repeated examinations.

The *onset* of the disease is usually sudden. Occasionally the onset is gradual and it may not be possible to tell exactly when the child was taken ill. The severity of the initial symptoms bears no relation whatever to the subsequent course of the disease, as one sees a very mild onset followed by a most extensive paralysis and even death, and other cases coming in a most fulminating manner which subsequently clear up entirely. The first thing observed about the child is that it is ill, and, of all the symptoms noted, *fever* is the most constant. There are, perhaps, exceptional cases in which the febrile stage is slight and short, and easily overlooked by ignorant or careless parents, but in cases under careful observation the afebrile attacks are certainly most exceptional.

The second most notable symptom is the presence of *pain*, and, in children old enough to locate the pain, headache is, next to fever, the commonest symptom. The pains may be in any part of the body and

may be so marked as to overshadow all other features of the disease, or they may be so trifling as to be only elicited by special examination, with all gradations in between. The commonest pain, next to headache, and of decidedly more value in diagnosis, is a tenderness and pain along the spine and down the legs, reaching to the heels or even the soles of the feet; another very common and suggestive pain is that in the neck and back of the head. If the head is bent forward this is usually tremendously increased, causing the child to cry out and resist very markedly. If there is not much pain present, it can usually be elicited by bending the legs up and the head forward so as to flex the spine. In some children the pain is present only when one attempts to move the arms or legs, or various parts of the body; in others, it is spontaneous, and the child cries out most of the time with it; and in still others there is hyperesthesia, so that the slightest touch, without any movement whatever, elicits an unusual degree of suffering. In some cases pain is elicited on gently squeezing the muscles.

There is often slight stiffness of the neck, and the child assumes a very suggestive *attitude*, lying on one side or the other, but not on the back, so that the head may be thrown slightly backward. The legs are usually drawn up, although not always. The disease may be ushered in with a convulsion, or convulsions may occur in the course of the disease.

The *mental condition* is extremely interesting. The commonest form of disturbance consists of very marked drowsiness which is replaced by a most extraordinary irritability when the child is aroused, but when you cease to examine him he rolls over into his former position and dozes off again. Other children are extremely restless and irritable and some are wide-awake, with a hyperacute mentality. With this is a very evident delirium, or a tendency to delirium. These cases, in my experience, are of the worst possible type and usually die. In some children there is a very marked delirium, talking, muttering, and this is accompanied with a tendency to move about in the bed and change the position frequently.

Movements are exceedingly suggestive, the child tossing from side to side and not lying in any position more than a few moments, sitting up, standing up, and half-turning from side to side in a perfectly purposeless way. If the child is watched carefully, fibrillary twitching of the muscles will very often be seen; at other times all the muscles will tremble. In rare instances the muscle is more or less spastic and may stiffen when the extremity is taken hold of, to relax a few moments later.

The *gastro-intestinal symptoms* are not uncommon. Anorexia is the rule. Vomiting may be present and may be so marked as to suggest acidosis. Constipation is rather more frequent than diarrhea, but the latter is frequently met with. The throat is often reddened; the redness is general and not limited to the tonsils, and in some cases there is

a considerable amount of coryza and slight suffusion of the eyes. Another curious feature met with, both early and later on in the disease, is the tendency to profuse sweating. This may be as marked as the colliquative sweats seen in typhoid. Sometimes the sweating is limited to one part of the body, as to the face or neck, or to one extremity, sometimes to one-half of the face. In some cases there may be retention of the urine, and this should always be looked for.

Usually, as Wickman has suggested, the disease presents certain dominant features. The cases which are like the course of a general infection have nothing to suggest the diagnosis, or they may have some one of the things mentioned above; the general history of the attack being that the child is taken ill suddenly with an attack of vomiting, followed by a fever of from 101° to 103° or 104° or sometimes higher, with headache, and feeling very badly, but without any definite symptoms of any kind. This may clear up in twenty-four hours or it may last two, three, or rarely, four days, when the symptoms disappear entirely and the child has nothing whatever to show for it. These cases are seen in connection with two or three or more cases in a family or a group of children and the diagnosis is made or suspected by the fact that the child was taken ill at the same time with identical symptoms or nearly so, to one or more definite cases of the disease in the immediate surroundings. These cases present the greatest difficulty in diagnosis. The meningeal form is the most suggestive of all, and one almost immediately realizes that he has either to do with a beginning poliomyelitis, a meningitis, or a meningismus. In these cases it will be found that there is an anterior and posterior stiffness of the neck; Kernig's sign may be present or absent; McEwen's sign, elicited by percussing and auscultating the cranium, may be present owing to distention of the ventricles of the brain with the fluid.

The patient may show a very *characteristic sign* at this time, or usually a little later, which may be described as follows: If the patient is raised by placing the hands under his shoulder, the head will fall back. If the child is told to raise the head when it is sufficiently conscious, it will do so, and hold it forward a moment or so when it will again fall back. This is a sign of very great importance. In some cases there is a curious vasomotor disturbance which is most often seen in the cases of the meningeal form. This consists of an alternate blushing and paling of various areas of the skin. It may be over small spots or over large areas, the part affected being redder than normal, and then, after a varying time, it may become paler than the surrounding skin, or present a normal appearance. Sometimes the flushing is very transient and is only a momentary wavering flooding of the superficial vessels. There is practically never any question, in these cases with a meningeal irritability, of the advisability of a lumbar puncture; it should be done as soon as possible, and it usually clears up the diagnosis immediately.

The cases with marked *pain*, resembling influenza, should suggest poliomyelitis. In my experience, I have rarely seen cases of influenza with as much pain or with the kind of pain as described above, although they do occur. In these cases a lumbar puncture should be done to settle the question of diagnosis. The gastro-intestinal cases are more difficult because one does not always have in mind the possibility of a poliomyelitis. The child is taken with a fever with intense vomiting, and if the child has a history of acidosis with vomiting before this the physician may be thrown off his guard. In some of these cases, if the child is carefully observed, some of the special features mentioned above may be elicited, but if they are absent the diagnosis may be impossible.

The presence of a very marked diacetic acid reaction in the urine will incline one to believe that the case is one of acidosis, though it must be borne in mind that an afebrile condition will show diacetic acid in the urine, although the reaction is not as marked. The cases with sore throat and coryza are also difficult and practically impossible to tell unless a careful examination elicits some suggestive symptom or signs. This preparalytic stage, when it does not go on to the development of a paralysis, shows what we have called an abortive case, and may subside in twenty-four hours or it may last two, three, or four days, occasionally five, six, seven, or eight days; in a few instances longer, but rarely. In some of these cases the convalescence may be slow and the child may suffer with indefinite symptoms for days or even weeks after the attack. These consist chiefly of pain coming on at any time, but more often at night, sometimes waking the child up out of sleep. These pains are usually transient and disappear either spontaneously or after rubbing the affected part. In some instances the pain is accompanied with cramps in the muscles. The child may tire readily on exertion, even though he has shown no paralysis or loss of power, or the tiring may be localized to certain groups of muscles or to one extremity. When this is the case one might assume that the spinal cells supplying this part had been affected, but not sufficiently so to have it made out. If the child is old enough to make special tests of the power of the muscles, according to the method suggested by Lovett, the diagnosis may be even more certain.

The Paralytic Cases. The classical type of the disease is too well-known to need any description, but, in passing, it may be well to call attention to one or two things about Wickman's classification. The ordinary form of disease is, of course, what he calls the spinal poliomyelitic form, cases with spinal paralysis so graphically described by Heine in his original monograph of 1840, and so beautifully elaborated on later by Medin, from which contributions the name of Heine-Medin disease was derived. The cases resemble Landry's paralysis, and usually start in the lower part of the cord and work upward until they involve the medulla, with paralysis of the respiration and death. There are other

spreading forms which may involve one part of the cord after another. It is highly probable that the cases formerly described as Landry's paralysis are, for the most part, if not all, poliomyelitis, but one must bear in mind that other bacterial toxins may cause rapidly increasing paralysis due to changes in the spinal cord, so that it is well not to be too dogmatic on insisting that every paralysis is poliomyelitis. The bulbar, or pontine, form of the disease may start as such, or it may develop later in the course of the disease through extension from either above or below. In the section on diagnosis, below, I have a few other comments to make upon this type of the disease which may, at times, present clinical pictures which do not immediately suggest poliomyelitis unless one has had a rather extensive experience with the disease. The encephalitic cases should include only those of the Strümpell type, the ones affecting the upper motor neuron and accompanied with spastic paralysis. This term encephalitic has been misused, inasmuch as cases showing any signs of bulbar, cerebral, or meningeal involvement have been dubbed encephalitic. One should therefore read the word with the author's intent in mind, but it would be well to limit the term as suggested. The ataxic cases may or may not show some paralysis, but the main feature of the disease is a marked ataxia of a cerebellar type. This may be present to a lesser degree in some of the paralytic cases and may disappear entirely. Cases of ataxia without any paralysis, however, have occurred but are rare. The polyneuritic type is more clinical than anatomical. It has been doubted whether there is any real involvement of the nerves themselves. As far as I know, no one has reported changes or inflammation in the peripheral nerves, although changes are common enough in the nerve roots. The polyneuritic cases are those which are characterized by a great deal of pain, but are, perhaps, all of the first group with certain changes in the nervous system causing the intense hyperesthesia. The meningitic type, met with very frequently and much too commonly called meningitis, is usually described in those cases in which symptoms of meningeal irritation are very pronounced and which resemble a true meningitis. A few additional points are given on this in the section on diagnosis below.

If the case is going to be a paralytic one, it is usually manifest within one to eight days. The paralysis comes on most frequently on the second, third, or fourth day, and may rarely come on without any previous history of illness, the child being found with a paralyzed limb, generally on waking up in the morning. The paralysis may be delayed and appear much later.

In *PROGRESSIVE MEDICINE* for 1911 I reviewed at some length the New York and Massachusetts reports and have given a number of tables showing the frequency of different symptoms and the frequency with which various parts are affected.

An article of unusual interest from the stand-point of unusual clinical

pictures due to poliomyelitis has been written by Guinon and Pouzin.¹ It consists chiefly in the relation of cases and it cannot be satisfactorily abridged.

THE BLOOD. The most complete studies on the blood have been made by Peacock, Draper and Douchez, in their monograph which was published by the Rockefeller Institute in 1912. The blood does not show anything characteristic, but merely suggests that there is an infection in the body. There is a constant and marked increase in the leukocytes, generally a polymorphonucleosis. The increase in the total number of cells may be as high as 30,000. There is generally an increase in the polynuclears of from 10 to 15 per cent., and a diminution of the lymphocytes of from 15 to 20 per cent. In 1 case a marked leukopenia was noted. The blood cells themselves present no abnormal appearance. The blood picture is so variable as not to afford any information of value as regards diagnosis. It has been suggested, however, that the disappearance of the leukocytosis might prove a good guide for the beginning of massage and other treatment. This return to the normal varies in different patients, three or more weeks usually elapsing before the blood picture is what it was before the patient was taken with the disease.

THE CEREBROSPINAL FLUID. The cerebrospinal fluid in practically all cases, if not all, of the cases which show nervous symptoms, is abnormal, and may present a number of different changes, which, in the main, are constant. The fluid is sterile, usually clear, and sometimes a slight fibrin web forms in it. In exceptional cases the fluid may be cloudy or even bloody. Usually, the presence of blood means a faulty technic, the error generally being the use of a needle without a sufficiently close-fitting obturator. The number of cells is definitely increased. The normal fluid contains from five to ten cells per cubic millimeter, while in poliomyelitis the number of cells is increased from sixteen to twenty to one hundred, but in some instances this number is greatly exceeded, as high as five hundred or over being met with. In the early stage of the disease, before the paralysis has made its appearance, the chief type of cell found is the polymorphonuclear. Sometimes they form from 80 to 90 per cent. of the cells present. After the appearance of the paralysis, the cells found are chiefly lymphocytes and from 75 to 100 per cent. of the cells present are that of the mononuclear type. There are also present large mononuclear cells of an endothelial type which have been regarded by DuBois and Neal² as rather characteristic of poliomyelitis. There are also phagocytic cells present. It must be borne in mind that even a slight admixture of blood in the fluid will account for a certain number of polynuclear cells. The cells rapidly disappear from the cerebro-

¹ Archives de médecine des enfants, August, 1916, p. 393.

² American Journal of Diseases of Children, January, 1915.

spinal fluid, so that after the first two weeks the count is either normal or nearly so. The fluid is sterile, gives a positive Fehling's reaction like the normal fluid, and usually contains a very definite reaction for globulin, which is, however, not as pronounced as that found in the various forms of meningitis. During the first week, globulin is found in perhaps one-half of the fluids examined. Pandy's test will, as a rule, be found easy and reliable. The globulin increases, as a rule, until about the third week, when it decreases, but a slight increase may be detected even after seven weeks or longer. The reaction to Fehling's solution is of slight value in diagnosis, inasmuch as in tuberculous meningitis, and sometimes in meningitis due to other organisms, this power to reduce Fehling's solution is absent. If the reaction is present, it means nothing; if it is absent, it is a point against poliomyelitis.

The accompanying table of DuBois and Neal will be found of great value in giving immediate information concerning the different kinds of fluid:

DIAGNOSIS. The diagnosis of the disease presents certain difficulties, the commonest of which are in the cases in the preparalytic stage. If it is borne in mind that the disease may be regarded as a general infection and that various parts of the body may be affected, one understands more readily the rather protean symptomatology of the disease. At the present time the most important thing to confirm the diagnosis is the examination of the cerebrospinal fluid, and abortive cases showing a normal fluid must therefore remain more or less doubtful. The question of whether the child may have poliomyelitis without having any changes in the cerebrospinal fluid is, at present, an open one. The general rule is, if a case shows a normal spinal fluid, that it is not to be regarded as poliomyelitis. Usually, when there are any symptoms whatever of involvement of the nervous system, the case turns out to be one of poliomyelitis. One sees a patient occasionally, particularly in association with other cases in the same family, in which the cerebrospinal fluid is normal, but in which the patient was strongly suspected of having the disease. This point might possibly be cleared up by a series of observations upon animals. Another method of diagnosis which has been employed, but which is not suited for ordinary use, is to take the serum from the suspected case, mix it with a fatal dose of the virus and, after incubating it, inject it intracerebrally into monkeys. A failure to develop the disease would indicate that the virus had been neutralized, but it must be borne in mind that serum from persons having had the disease recently will also neutralize the fluid, and if the individual had passed through an unrecognized abortive attack, the results could well be misleading.

The diagnosis of the paralysis itself is not always easy. In older children it is usually apparent, and the child will tell you he cannot make certain movements if asked to do so, unless he be too ill to take notice.

CHARACTERISTICS OF THE VARIOUS SPINAL FLUIDS.

Meningeal condition.	Pressure.	Amount, c.c.	Appearance.	Cytology.	Bacteri- ology.	Albumin.	Globulin.	Fehling's solution.	Animal inoculation.
Normal	Normal	5-10	Clear	Very few cells	Sterile	±	±	+	Negative.
Meningismus . .	Increased	10-100	Clear	Very few cells	Sterile	±	±	+	Negative.
Poliomyelitis . .	Increased	20-100	Clear; some- times slight fibrin web	Early polynu- cleosis; later lymphocyto- sis up to 95 per cent.; en- dothelial cells	Sterile	+ - + +	+ - + +	+	Negative.
Tuberculous menin- gitis	Increased	30-120	Clear fibrin web	Lymphocyto- sis up to 95 per cent.	Tubercle bacilli	+ + - + + +	+ + - + + +	- in 25 per cent.	Tuberculosis in four weeks.
Epidemic cerebro- spinal meningitis	Increased	5-120	Cloudy	Polynucleosis up to 98 per cent.	Meningo- coccus	+ + - + + +	+ + - + + +	+ or - accord- ing to severity and stage.	
Meningitis due to other organisms .	Increased	20-100	Cloudy	Polynucleosis up to 98 per cent.	Infecting organism	+ + - + + +	+ + - + + +	- may be + early.	

In the very sick and the very young, the production of pain or of tickling must be used, and the unparalyzed member will be used to protect the paralyzed one, or to brush away the source of irritation. In young babies, picking up the child with the hands under the shoulders and buttocks, leaving the limbs free, will usually reveal the paralyzed parts. The normal infant moves all its members; in the paralyzed, the affected part hangs in marked contrast with the moving arms or legs. In very ill children this is not as effective, but still of value.

Before the onset of paralysis, or when it is unrecognized, the case may be mistaken for almost any acute febrile disturbance, and great care should be taken to elicit changes in the nervous system. In the presence of an epidemic even comparatively slight changes may be sufficient evidence on which to do a lumbar puncture and most parents will welcome any method which abridges their suspense. The most common sources of error, apart from conditions with nervous symptoms, are as follows:

Croup or Laryngitis. With a paralysis of the laryngeal muscles the case may present such dyspnea as to require intubation, and the child may be suspected of having croup, laryngitis, or laryngeal diphtheria. Other paralyzes will generally be found on careful examination, and the absence of any other evidence of diphtheria will generally make the case clear.

Bronchopneumonia. A child with a paralysis of the respiratory muscles may suggest a pneumonia. Upon careful examination, either the thoracic muscles or the diaphragm will be found paralyzed. The fixed chest wall, either on one or both sides with exaggerated abdominal breathing, characterizes the first. When the diaphragm is paralyzed, instead of inspiratory distention of the abdomen there is an inspiratory retraction. With hurried respiration and a little bronchitis or pulmonary edema, the physical signs may be misleading unless one is unusually skilled.

Nephritis with Uremia. This may be misleading on account of the convulsions or coma. The edema and urinary findings will be sufficient to clear up the diagnosis, or a lumbar puncture may be done.

Acidosis; Cyclic Vomiting. This may be very misleading. The profound languor may suggest a generalized slight loss of power, such as is sometimes seen. These may be twitching of the muscles, and other nervous symptoms. The acetone odor of the breath, and the marked diacetic reaction in the urine will point the way. The reaction in ordinary febrile disturbances is rarely as pronounced as in acidosis. A lumbar puncture may be needed.

One should bear in mind that poliomyelitis may coexist with other diseases and with injuries. A surgeon recently told me of a case occurring in a boy with a broken arm. A couple of weeks after the arm had been put up, it became very painful, and there was a slight fever. It turned out to be poliomyelitis. The disease complicating medical disease is readily imagined and needs no further detail.

A second class of disease in which there is pseudoparalysis or spasm may also cause difficulty in diagnosis. This includes scurvy, rickets, hysteria, the spasmophilia seen in nutritional disturbances, and tetany.

Scurvy. In severe scurvy the child assumes a position which suggests poliomyelitis. The paralysis is only apparent, and the child can be made to move the extremities if sufficiently irritated. In the very late cases the muscles will be seen to move if the limbs do not. The reflexes are normal. There are, in addition, the classic signs, the bleeding of the gums, the submucous and subdermal hemorrhages, the periosteal swellings, etc., and symptoms rapidly disappear on the administration of orange juice.

Rickets. In acute rickets there is a pseudoparalysis like that described in scurvy, but in place of the scorbutic symptoms one has the marked evidence of rickets.

Tetany. The characteristic position, the spasm being chiefly in the hands and feet, and bilateral, the exaggerated reflexes, the contraction of the muscles on percussing the nerve, best seen in the facial, and the local spasm caused by constricting a limb, make the diagnosis easy.

Spasmophilia. Apart from tetany, a definite tendency to contraction of the muscles exists in certain poorly nourished young infants. The reflexes are increased, and the stiffness of the muscles is general.

Hysteria. This may present some real difficulties. Fortunately, it is rare in older and practically absent in young children. The reflexes are normal and there are sensory disturbances, usually anesthesia of the glove and stocking type. If the condition has existed for some time, the absence of marked atrophy is of value.

The third class of cases includes those in which there is some definite disease of the nervous system. To avoid repetition *let me insist upon the necessity of getting the history of the attack.* This will save many embarrassments and will also eliminate the congenital conditions. The history may be impossible or difficult to get or may be misleading, but usually it will help tremendously.

In this connection one must bear in mind the possibility of encountering an old poliomyelitis with some intercurrent fever added. We are dealing only with the diagnosis in the acute stage or near it, so that the differential diagnosis between the old nervous lesions will not be touched on. *The examination of the cerebrospinal fluid is the deciding point.*

Tuberculous Meningitis. This may give more difficulty than any other condition. The general appearance, as a rule, is different, but this may not mean much until the child has been seen several times. The cerebrospinal fluid is under greater pressure than in poliomyelitis. Sooner or later there are changes in the eye-grounds. The onset is more slow, more irregular. The dominant symptoms are drowsiness, vomiting, irregular pulse and respiration, convulsions, and rigidity of the muscles. The reflexes are increased. In poliomyelitis the length of time to reach

the same stage is much more brief, and, while in the incubation stage there may be rigidity and increased reflexes, the tendency is to become flaccid and to have a loss of reflexes.

Cerebrospinal Fever. At the onset, the two diseases may be strikingly alike. The sudden onset, with vomiting and high fever, the prostration and rigidity of neck and extremities, the drowsiness with irritability and hyperesthesia, may be simulated by poliomyelitis. The petechial eruption, if present, is a help, and after a few days the marked spasticity and increased reflexes give a picture usually easy to distinguish.

Other Forms of Meningitis. Much as above, the diagnosis depending on finding the causal organisms in the cerebrospinal fluid.

Meningismus. Meningeal symptoms, drowsiness, retraction of the head, etc., may be seen in connection with inflammatory diseases of the body elsewhere, as in pneumonia and enterocolitis. This may be intensified by a great loss of fluid from the body, as in the last-named disease. These conditions may tax the diagnostic powers if only the symptoms and physical signs are depended upon. The recognition of the existing disease and the cerebrospinal fluid clear up any doubts.

Cerebral Thrombosis. This is seen in connection with inflammatory diseases elsewhere in the body and the diagnosis may not be suspected. If symptoms are produced that stand out above those of the condition causing it, they are convulsions and paralysis, either localized or general, strabismus, and coma. When the disease extends from a neighboring inflammation, as in the nose or ear, the symptoms may be more marked and consist of headache, drowsiness, and, if pyemia occurs, chills, sweats, and a high, variable temperature. I have seen one instance of a lateral sinus thrombosis in which the drowsiness and irritability were not unsuggestive of poliomyelitis. The localizing symptoms, cyanosis of the face with dilatation of the temporal and frontal veins in thrombosis of the longitudinal sinus, the marked edema of eyelids and face and protrusion of the eye in cavernous thrombosis, and the extension into the neck in lateral sinus trouble, soon make the diagnosis plain.

Mental Deficiency. When there is some febrile disturbance, this has more than once been mistaken for poliomyelitis. The history, if obtainable, and the subsequent history, if not, will generally make the question clear and one can always resort to a lumbar puncture. I have seen some extraordinary clinical pictures when the two were associated.

Amaurotic Family Idiocy; Tay-Sachs Disease. This, too, can be mistaken if there is an intercurrent fever, as the flaccidity suggests poliomyelitis. The condition affects all the muscles, the blindness is apparent, and there are characteristic changes in the eye-grounds. It occurs in Jews, and the history of gradual onset, beginning between the third and sixth month, is usually obtainable.

Transverse Myelitis. This may occur in connection with the acute infectious diseases. The increased reflexes below the lesion, and the involvement of bladder and bowels, ought to make the diagnosis easy.

Pott's Disease. By pressure this may cause a paralysis, with increased reflexes. The diagnosis is usually apparent, but cases have been sent to hospitals as poliomyelitis.

Congenital Spastic Paralysis. Despite the fact that these do not resemble acute poliomyelitis, they have been mistaken for it. The differential diagnosis of late poliomyelitis and these cases is another story.

Chorea. This disease has also been mistaken for poliomyelitis, but ordinary careful examination ought to solve the difficulty.

Facial Paralysis; Bell's Palsy. In times of epidemic this may give considerable difficulty. In doubtful cases the only way to clear up the diagnosis is by lumbar puncture, but a facial paralysis coming on after definite exposure to cold and preceded by earache may be called Bell's palsy, and the same is true of cases in which there is marked involvement of the ear. On the other hand, a case coming on with a history similar to poliomyelitis can pretty safely be classed as that disease.

Peripheral Neuritis. Cases of this disease may cause very distinct difficulties in diagnosis.

In the cases following infectious diseases, particularly diphtheria, there is a history of throat involvement. The most common forms of paralysis are those of the soft palate and of the eye muscles, particularly of the accommodation. The patient often shows irregular heart action, with dilatation of the heart. In poliomyelitis, the paralysis comes on within a few days, usually within the first eight days. In diphtheritic paralysis the onset is later. In Rolleston's series, on which I commented in *PROGRESSIVE MEDICINE* for March, 1914, the only forms of paralysis which occurred during the first two weeks were those involving the palate and the so-called cardiac paralysis. The ocular paralysees are more apt to occur during the fourth and fifth week, although some occur in the third, and paralysis involving the lips, pharynx, or diaphragm almost always occur later than this, that is, during the sixth, seventh, and eighth week. In cases seen early, a lumbar puncture will settle the question, but in cases occurring late, in which no history can be obtained, the difficulties of diagnosis may be almost unsurmountable.

The Accuracy of Diagnosis. During the recent New York epidemic, 9418 cases were reported, of which 4474 were treated in health department hospitals. Of these, 96 were found after observation to be free from any serious illness. Of the remaining 4378, 49 were found to have some other disease. This is an unusually good showing, being approximately only 3 per cent. of the patients sent to the hospitals with other diseases, which, considering the intense public interest with the consequent state of mind of both the public and profession, is a very creditable record.

Of 2715 patients followed up in their homes, 1885 were found to have a serious paralysis of one or both legs, and to be unable to walk; 530 were

partially paralyzed in the legs, but able to walk; and 273 had one or both arms totally paralyzed.

PROGNOSIS. The prognosis of poliomyelitis can be divided into whether or not the child will survive, and if he survives, what are the chances of perfect recovery. The number of cases that die varies in different epidemics; roughly speaking, from 5 to 20 per cent. Some epidemics seem to be distinctly more fatal than others.

As regards the paralysis, there is no way of determining at the present time whether paralysis will occur or not, nor is there any way to determine how far it will spread after it once starts.

If complete recovery takes place, it does so within six weeks. As a general thing, what happens is a partial recovery of the muscle power, with a more or less complete restoration of function. Sometimes, unless a careful examination is made, the patient has the appearance of complete recovery, but on becoming fatigued, on a careful examination as to function and sometimes in making very rapid movements, the deviations from the normal become apparent. The best guide as to whether any muscle or muscle group may be affected, is the early spontaneous improvement in function and the recovery of the reflexes. The recovery from reaction of degeneration is also of value if one is trained in testing for it. Stern¹ has given an account of the prognosis and lays stress on the influence of correct early management. This, of course, has a very definite influence on the ultimate outcome.

The value of *electric reaction* in prognosis has been greatly overestimated. The statements of Duchenne, of Boulogne, made many years ago, covers the ground satisfactorily as far as the general practitioner is concerned. He summarized the question as follows: "Diminution of electric contractility from the first in direct proportion to the amount of damage done to the innervation of the paralyzed muscles; after a time return of electric contractility in those muscles, or parts of muscles, the tissue of which is not changed." Anyone interested in the question of electricity in poliomyelitis will do well to read Duchenne's article which is available in the Sydenham Society's publications for 1883. This whole question of electric reactions needs to be studied by specialists.

Rapid and complete atrophy of a muscle or muscle group usually means the destruction of the corresponding nerve cells and the outlook for recovery of power is poor if not hopeless.

Another point in prognosis consists of the question of the danger of subsequent cord affections. The statement is often made that individuals who have suffered with poliomyelitis are more liable to organic nerve lesions later on. As to this there seems to be some question, inasmuch as comparatively few cases have been actually reported, and one

¹ Journal of the American Medical Association, July 29, 1916, p. 325.

must always allow for the possibility of coincidence. These individuals are probably more subject to functional nervous disturbances, particularly those who have extensive loss of power. Of the effects that have been described in association with old lesions are chronic muscular atrophy, progressive myopathy, and multiple sclerosis. Crouzon has described a man who had poliomyelitis in childhood and between eighteen and forty years of age had nine different attacks of temporary hemiplegia. Pierre-Marie has called attention to a form of scoliosis coming on about a decade after the acute attacks, which he called "*scoliose tardive*."

As to the *mortality*, the extremes are given by Wickman, who, in a small epidemic of 26 cases saw a mortality of 42.3 per cent.; and on the other hand, in another of 41 cases, the mortality was only 10 per cent. The same author gives 143 fatal cases in which the death occurred within ten days, and, of these, 65 died within four or five days of the onset. If the patient survives the tenth day, the danger of death is largely, if not entirely, passed.

As to the paralysis, Wickman, in 530 cases, reports 56 per cent. as paralyzed, and 44 per cent. as cured. In the Massachusetts epidemic, 16.7 per cent. are reported as cured. These figures could be multiplied to a great extent, but they show the variations as noted by various observers.

The following table shows the comparison of poliomyelitis mortality with that of some of the other diseases of early life:

DEATHS OF CHILDREN UNDER FIVE YEARS OF AGE.

City of New York (All Boroughs).					Six months.
	Order.	1913.	1914.	1915.	1916.
Diarrheal diseases	1	3718	3579	3924	884
Diphtheria	2	972	1143	967	556
Measles	3	596	534	593	369
Whooping-cough	4	415	273	385	213
Scarlet fever	5	307	285	174	47
Acute poliomyelitis	6	33	24	10	57

Lovett, in his treatment of infantile paralysis,¹ has studied the degree with which the muscles are affected, and gives a table showing the number of muscles paralyzed, the number which are partially affected, the number completely paralyzed, and also the proportions of total paralysis.

TREATMENT. There have been a number of articles dealing with the treatment of the disease and giving more or less the same information. Among others may be mentioned that of Lovett.² For the purpose of

¹ Philadelphia, 1916.

² Weekly Bulletin of the Department of Health of the City of New York, August 19, 1916, p. 265.

describing the treatment, the disease may be divided into an acute stage, beginning with the onset and ending with the disappearance of the tenderness, a stage which lasts a variable length of time, sometimes three or four weeks up to about three months. The convalescent stage, from the disappearance of the tenderness until the disease has become practically stationary. This stage lasts about two years; and, lastly, the chronic stage which begins after the disease has come definitely to a standstill. The treatment may be considered under the preventive treatment, the general treatment, and the special treatment.

As *preventive measures* there have been one or two suggestions. In monkeys there is some evidence that *hexamethylenamin*, given before or at the time of infection, lessens the incidence of the disease or may prevent it altogether. The use of nasal sprays and douches, and of gargles for the throat are not to be recommended as a general thing, inasmuch as it has been proven experimentally that the ordinary agents used for this purpose do not prevent the development of the disease, and secondly, because the use of antiseptics in the nose and throat for any considerable period of time is liable to cause an irritation with consequent injury to the normal protective agents inherent in the mucous membrane. When an individual has been very definitely exposed to the disease, there can be no objection to the use of a 10 per cent. argyrol solution in the nose in the recumbent position, so that it covers the nasal pharynx completely. This may be used, 5 to 10 drops in each side of the nose, three times a day for two or three days. It should not be kept up for any long periods of time.

The *treatment of the disease after it has developed* consists first, of keeping the child at rest. This means that the child should be put to bed and kept there until all the tenderness has disappeared. The various mechanical appliances ordinarily used for immobilization may be brought into use according to the needs of the case. This consists of putting the patient up in splints, the use of casts, mobilizing by properly applied adhesive bandages, or the use of the Bradford frame. Great care should be taken to keep the muscles and tendons from being unduly stretched by the overaction of the unparalyzed muscles. One of the commonest neglects is to allow foot-drop with the consequent stretching of the muscles and tendons on the anterior part of the leg. This is easily prevented by casts or splints, and, in older children, by properly applied strips of adhesive plaster. The immobilization also lessens the pain, and in cases in which there is unusual hyperthesia, the casts or frame should be used for the purpose of lessening the discomfort of the child. In all cases in which there is much hyperthesia, it is well to keep the bedclothes free from the patient by the use of a suitable wire frame. The length of time that the child should be immobilized varies largely, depending considerably upon the character and extent of the paralysis and the amount of hyperthesia present. Personally, I think that it is a good plan after

two or three weeks, if the child is placed in the cast, to cut the cast so that the child may be lifted out of it for a short period of time every day, a procedure which certainly lessens the tendency to atrophy and improves the circulation in the affected members. In patients with very extensive paralysis, the care of the child will be greatly lessened by the use of a cast or Bradford frame. This lessens the danger of bed-sores and irritation of the skin, inasmuch as the child can be elevated from the bed and is not soiled by discharges. The pain is best treated, as already stated, by immobilization. When this is not advisable or even when it is employed, heat will be found to be a very important adjunct to the treatment. Many of these cases have a very deficient circulation and a lowering of the temperature of the affected limb. Wrapping the legs in flannel or the use of a hot-water bag or an electric pad will be found in many instances to give the greatest amount of comfort. If the pain is unusually severe, there can be no objection to the judicious use of some of the ordinary anodynes; codeine, combined with antipyrine or phenacetin, being the most effective in my experience, but, unfortunately the former drug is practically off the market at this time. There is no good to be derived from the internal use of any drugs given with the idea of changing the course of the disease. As soon as the child can be moved without discomfort, it may be given a warm salt bath once a day. This is most easily given by placing the child on a sheet and allowing him to sink gradually into the water. It is not well to begin this too soon. The child is able to move more easily in the water than out of it and it facilitates the circulation, both of the blood and lymph. The use of lumbar puncture for relief of the patient in the early stage is given below.

There are a number of points in the treatment of the acute stage of the disease which need mention. *Retention of urine* is not uncommon, and, if care is not taken, the bladder may be so distended as to be incapable of emptying itself normally. The child should be urged to urinate at four-hour intervals, if possible, and in case of not doing so, should be catheterized.

Respiratory failure is a phase of the disease requiring treatment, usually without avail. The disease may progress from below upward, and in that case is usually due to paralysis of the ordinary muscles of respiration. The thoracic muscles may be affected and the abdominal muscles may also help to impede respiration, or the diaphragm may be paralyzed. When the diaphragm is paralyzed, instead of normal inspiratory protrusion there is a typical inspiratory reaction owing to the lax diaphragm. The respiratory center itself may remain intact and the individual die from the muscles of respiration being affected. In those cases in which the respiratory center is intact, the accessory muscles of respiration continue to be called on owing to the degree of asphyxia present. If the patient is kept alive by artificial respiration,

the respiratory center may eventually become involved, the circulation may eventually fail and cause the child's death. In cases in which the lesion appears from above and spreads downward, Meltzer believes that the vasomotor center may be first affected, and that death may be due to the rapid fall of blood-pressure. Where respiratory failure comes on, artificial respiration may be used, preferably by some form of pulmotor or lungmotor. It may be used either with or without oxygen. Landolt has kept a patient alive seventy-two hours by artificial respiration, but the patient eventually died. This is the fate of practically all of the cases with which I am familiar in which artificial respiration has been done, but there may be cases in which during the period of artificial respiration the disease may cease to extend and recovery take place. One sees cases in which there has been a very marked respiratory involvement and in which recovery takes place with a permanent paralysis of the thoracic muscles. In these very severe cases the suggestion of Meltzer, of the administration intraspinally of epinephrin, might be borne in mind, and I have had one child who had a beginning respiratory failure who seemed to have been very definitely improved by the use of epinephrin, and which eventually recovered. Of course, one case means nothing. The use of epinephrin according to Meltzer's idea is given more extensively below.

In some of the early cases there seems to be symptoms due to a definite increase in the fluid. These are chiefly stupor, twitching, convulsions, and some embarrassment of respiration. When this occurs, a lumbar puncture, withdrawing a certain amount of fluid, will often give a certain amount of relief, and this may be repeated, if necessary. In many instances a puncture done for the purpose of diagnosis is all that is necessary.

Convalescent Stage. When the tenderness has practically disappeared, the question of more active treatment may be considered. During this stage there are four measures of definite value: Massage, electricity, heat, and muscle training. Massage is of great use in helping to keep the muscle tone and in stimulating the circulation of blood and lymph. This massage should not cause any pain or discomfort; it should be given gently at first and never too vigorously, and care should be taken not to fatigue the muscles by giving too severe or too long a treatment. It is better to use massage twice a day for a shorter period than once a day for a longer period. In the beginning, five minutes may be long enough, and this time may be gradually extended until one-half hour is taken to go over the entire body, paying particular attention to the paralyzed parts. In younger children, twenty minutes at a time will suffice. If the child becomes irritable, or shows any signs of fatigue, the treatment should be discontinued.

The use of *electricity* in hospitals in which there is proper apparatus and someone trained in its use may be advised. It will be found to do

very much the same thing as massage, and in cases of older children serves to divert them for a certain time of the day. As far as is known at the present time, electricity does nothing more than to exercise the muscles. If the currents used are too strong, or if they are used for too long a time, it does more harm than good. I never recommend the use of electricity in the hands of inexperienced or ignorant people. An anxious mother with a battery with the belief that it possesses some extraordinary power, is an extremely bad combination.

Heat is useful in increasing the circulation and in raising the temperature of the limb to a point where muscular action is more easily accomplished. It is rather a good plan to warm the affected part before massage, and also before muscle training.

Systematic muscle training is one of the most valuable means of improving the patient's condition. There are always more nerve tissue affected than there is totally destroyed, and muscle training will serve to bring the inhibited centers into use, and it also apparently serves to send the impulses from the brain to the affected muscles over new nerve routes. There are numerous and complicated connections of nerves and nerve centers, and, where only partial destruction exists, much can be done in the convalescent period to increase the function of the various affected parts. This is best carried out under the direction of someone who is trained in the matter. In Vermont, in a period of three months, a quantitative examination of the muscles (Lovett and Martin)¹ shows that in cases treated by muscle training the expectation of improvement was as follows:

Under supervision, 3.6 to 1.

At home with supervision, 3.5 to 1.

At home without supervision, 2.8 to 1.

The question of fatigue is one of extreme importance. Under no circumstances should the child be allowed to move about or to receive any treatment of any kind to the point of producing possible tire. There seems to be a unanimous opinion that the full use of the muscles with stimulation and treatment definitely retards recovery and may so injure the inflamed nerve centers as to cause complete loss of function. Over-zealous physicians, nurses, and parents should be particularly cautioned about this.

This brings us to the question of *how long the child should be kept at rest*, concerning which there are very wide differences of opinion. Hogue and Capelka² believe that this may possibly be regulated by observing the white blood count. The leukocytosis persists for two or more weeks, and as it disappears they suggest that manipulative procedures may be begun. The amount of pain present, the tenderness, and the rapidity with which the function returns are, perhaps, the best guides. As long

¹ American Journal of Orthopedic Surgery, July, 1916.

² Journal of the American Medical Association, August 26, 1916, p. 666.

as there is any pain or tenderness, any manipulation of that particular part should be avoided. When there is rapid return of function, rapid disappearance of pain and tenderness, the child may be allowed to sit up as soon as it acquires the possibility of doing so with ease and without fatigue. Lovett believes that children should get up as early in the convalescence as is consistent with the condition of the child. This avoids deformities of the hips and ankles, which may take place in the sitting child, and also is of value in muscle training, inasmuch as the effort to balance on the feet excites a large number of muscles not otherwise reached. Overprolonged periods in bed tend to make the child lose its ability to balance, so that a longer period of instruction is needed to regain the sense of equilibrium. If apparatus is needed to allow the patient to walk, it should be used only in walking, and in early cases the process should not be allowed to be continued, but only during the time in which the child is being exercised. Crutches may, or may not, be required. Lovett states that a good general rule for the use of apparatus is that it should be used when the patient cannot stand without it, or, if, in standing, the position of deformity is assumed. This question of avoiding deformity cannot be too much insisted upon as it tends to straighten the soft parts and even deformities of the bones themselves, but most extraordinary deformities are seen in patients who have been totally neglected. Lovett¹ has described briefly the management of poliomyelitis with a view to minimizing the ultimate disability, and his article will be found full of useful information.

Serum Therapy. The basis for using a serum in this disease rests primarily on the fact that Flexner and Lewis, in 1910, demonstrated that monkeys which had had the disease and recovered could not be reinoculated. This was confirmed by other investigators. Subsequently, Römer and Joseph demonstrated that there were immune bodies in the blood of such monkeys which would neutralize the virus when mixed with it in a test-tube, and Levaditi and Netter, and also Flexner and Lewis showed that the same was true with the blood from human beings who had recovered from an attack. Flexner and Lewis after this demonstrated that monkeys which were actively immunized showed the presence of the same immune bodies. Flexner and Lewis then demonstrated that the serum from monkeys or from individuals who had had the disease, inoculated into animals with the virus, even from eighteen to twenty-four hours afterward and repeated during several days, would either inhibit development of the disease or limit its ravages if it developed at all. The disease could be prevented by the subdural injection of the serum, either after the injection of the virus into the blood or directly into the meninges. In the monkey the first symptoms of the disease are only from ten to twenty hours before the beginning

¹ Medical Record, October 21, 1916.

of the paralysis, and this usually occurs from six to seven days after the inoculation. Fortunately, in man the disease does not develop quite as promptly, and the preparalytic stage is ordinarily from two to four days. The first observations on using this serum in man were made by Netter,¹ Netter and Salanier,² and Netter.³ The serum was taken from individuals who had had paralysis, and even thirty years after an attack the immune bodies may still be demonstrated. Where it was possible, however, they preferred cases in which the paralysis was of not more than five years' standing. The individuals were carefully examined and the blood controlled by a Wassermann reaction. The introduction of human serum into the spinal canal was generally very well tolerated, but it causes an inflammatory reaction of the meninges, as is shown by specimens of the fluid drawn after subsequent puncture, the fluid at this time being cloudy and containing fibrin. The albuminuria is increased and the number of cells also increases, the polymorphonuclear cells predominating. Sometimes this fluid will produce a yellowish clot and many times there are no symptoms of any change going on, but occasionally there may be pain along the spine, with stiffness of the neck and body and a slight elevation of temperature. Only twice in 32 cases was there any alarm caused by the injection of the serum. Netter, in his 32 cases, had 6 complete and rapid cures, 3 cases so much improved as to approach a perfect cure, 7 were markedly benefited, and 5 appreciably so, but in these the influence of the serum was doubtful. In 3 cases the course of the disease was not modified, and 8 patients died, 7 from bulbar paralysis.

Netter believes that the serum is capable of stopping the course of the paralysis, or even causing it to disappear if already started. He thinks that if it is given in the preparalytic stage, it may prevent the occurrence of the paralysis. The serum should be used within the first four days to be efficacious, as after that he does not expect any real benefit. In one instance they did inject the serum in the preparalytic stage and there was no subsequent paralysis.

The reports of the use of the serum during the past year have not yet been made public, so that one cannot say definitely what value it has. In New York City⁴ a very considerable number of cases have been treated, either with fresh serum or that prepared with 0.2 per cent. tricresol, and passed through a Berkefeld filter. From 10 to 15 c.c. were injected intraspinally after the removal of a somewhat larger amount of spinal fluid, and this dose was repeated every twenty to

¹ Bulletin de l'Académie médecine, October 12, 1915.

² Bulletin et mémoires de la Société médicale des hôpitaux de Paris, March 23, 1916, p. 299.

³ Archives de Médecine des Enfants, January, 1916, p. 1.

⁴ Weekly Bulletin of the Department of Health of the City of New York, October 28, 1916, p. 345.

twenty-four hours until two or three doses were injected. The administration of the serum is followed with a slight increase in the irritative symptoms, but this is usually less marked when the serum is given late than if it is given in the early stages. The spinal fluid showed a marked increase in the polynuclear cells. Favorable results seemed to have resulted when the serum was used in the preparalytic stage of the disease and there seems to be an opinion that the mortality was probably favorably influenced. In the later cases, in which there seemed to be danger of the involvement of the muscles of respiration, in a certain proportion the serum seemed to have an inhibiting, and possibly a life-saving effect. The results justify the use of serum when it can be obtained, but personal communications from several of those who have used it seem to show that they are not as enthusiastic as they were at first.

Wells¹ seems to be favorably impressed with the value of the serum after using it in 15 cases.

Sophian² believes that the inflammatory reaction of the meninges and nerve substance is best treated by intraspinal injection of serum, either normal human serum, normal horse serum, or convalescent serum. Both normal horse serum and normal human serum can easily be procured, and, if sterile and properly injected, are harmless. In order to avoid sensitization to a foreign protein, it seems preferable to use human serum. This, when injected into the spinal canal, seems to cause a hyperleukocytosis which he believes to be of very definite value. He used this method with horse serum on a series of 10 patients, mostly cases admitted late, and believes that, in the few cases in which it was used early, some definite improvement was noted. The changes in the cerebrospinal fluid after the injection of the serum consist in a definite increase in the polynuclear cells and a very high cell count within eighteen hours, quite striking from the number of lymphocytes usually seen. Twenty-four hours after the injection the fluid becomes faintly opalescent, occasionally turbid, but examination shows a sterile fluid like that seen in septic meningitis. He also treated a small series of 10 cases with serum from convalescent patients and in some he thought he obtained favorable results, but not better than in those cases in which normal horse serum was used.

Adrenalin Treatment. Meltzer³ has given an account of the use of this treatment with certain suggestions regarding its applications in human beings. He calls attention to the differences between the inflammatory focus and the inflammatory area in poliomyelitis, just as it may occur in other inflammatory diseases. He gives his experience with the use of artificial respiration in monkeys dying from the disease. In his

¹ Journal of the American Medical Association, October 26, 1916, p. 1211.

² Ibid., August 5, 1916, p. 426.

³ New York Medical Journal, August 19, 1916.

studies he concluded that in cases in which there was an ascending paralysis death is due to a respiratory paralysis from an involvement of the origins of the chief respiratory nerves, while in cases of encephalitic poliomyelitis the vasomotor center may be the first to become paralyzed and death is due primarily to a rapid sinking of the blood-pressure. As had been pointed out by Peabody, Draper, and Dochez, the three facts in the acute pathology of the disease consisted of a cellular exudate, hemorrhage, and edema, which may be regarded as the primary reaction of the nervous system to the virus of the disease, and from this come changes which result in part from direct pressure on the nerve cells. Without going into Meltzer's arguments more fully, it may be said that he believes that if you can find a means by which edema and the other processes occurring in the inflamed zone can be kept down, the nerve tissues so affected ought to derive a definite benefit. In the use of adrenalin we have an agent which, when applied to inflamed areas, will lessen congestion temporarily.

Clark used this drug in some observations on monkeys, but only animals that were already extensively paralyzed or moribund were treated. Animals so treated seemed to show a very definite improvement for a time, although they eventually died. This method of treatment was used in over 70 cases at the New York Throat, Nose and Lung Hospital, and the results were said to have been favorable, although the report has been published, it has not come under my eye.

The technic of administration consists in injecting intraspinally 2 c.c. of a 1 to 1000 solution of adrenalin, and this is to be repeated every four to six hours. Before the first injection is given a fairly large quantity of spinal fluid should be withdrawn, the amount being in proportion to the pressure prevailing in the spinal canal. The subsequent injections should be made without regard to the presence or absence of spinal fluid and unless the pressure appears to be very high, not much of the spinal fluid should be withdrawn, because at this stage the spinal fluid may contain some valuable antibodies. All injections should be washed in with 2 c.c. of normal salt solution, but, if no spinal fluid is present, at least 5 or 6 c.c. of salt solution should be used.

In this connection he¹ has a short note, in which he states that more than 50 babies received an intraspinal injection of 2 c.c. of a 1 to 1000 adrenalin chloride solution every six hours from the very beginning of the disease, that is, as soon as the patients were brought to the hospital. All of the patients stood the 2 c.c. of adrenalin intraspinally for many days without the slightest harm.

In connection with the use of this drug in cases in which there is threatened respiratory failure, artificial respiration with some form of pulmotor, using oxygen, should be advised. Meltzer has devised an apparatus of this kind which he believes to be of special value.

¹ Journal of the American Medical Association, August 5, 1916, p. 461.

Pneumonia. THE URINE IN LOBAR PNEUMONIA. The changes in the kidney during an attack of pneumonia have been frequently studied, one of the best accounts being that of Fraenkel and Reiche,¹ who found that the chief changes were in the cortical layer of cells and but very rarely in the collecting tubules. In 22 out of 26 cases which they studied, pneumococci were found in the kidneys, and they believe that the presence of bacteria in the kidney was responsible for the nephritis which is so frequently seen. The urine in pneumonia is usually decreased in amount and frequently contains a trace of albumin and a few granular casts. Mathers² has made a study of 26 cases at various times during the course of the infection. In 10 of these, or 38.4 per cent., pneumococci were isolated from the urine. They usually appear at a time just before, or just after, the crisis, and do not seem to bear any definite relation to the pathological elements in the sediment. The pneumococci isolated were similar to those found in the blood and in the sputum. The organisms did not seem to grow to any appreciable extent in the urine, but, nevertheless, their presence would suggest a possible source of infection, particularly in hospital cases, and great care should be taken in handling it. Mathers believes that an examination of the urine for pneumococci may be of value in the diagnosis either of pneumonia or pneumococcus infections in general. In two instances, streptococci were isolated, but in both of these there were foci of infection in the mouth. At other times, staphylococci and diphtheroid bacilli were found.

Paratyphoid and Pulmonary Disease. Among the more recent studies made on paratyphoid bacillus is a contribution by Minet.³ His experience was gained in hospitals for typhoid installed behind the line of battle in France. A certain number of typhoid cases showed the presence of pulmonary symptoms, some of which showed only ordinary bacteria of the various kinds, whereas others showed paratyphoid bacillus, sometimes paratyphoid A and sometimes paratyphoid B. As far as Minet was able to determine without recourse to any bibliography, this was the first time in which the paratyphoid had been isolated from the sputum. He found these organisms in seven cases, and he describes four different types of pulmonary affection caused by them. In the first type the patient showed an ordinary bronchitis, and an examination of the sputum showed paratyphoid B in practically pure culture. The disease ran the course of an ordinary bronchitis. There were 2 cases of acute pulmonary congestion, one in the course of paratyphoid A, of which the paratyphoid A bacillus was recovered. The patient made a rapid and complete recovery. In the second case the patient was convalescing from an attack of paratyphoid B which had been rather mild. The patient was taken with a pulmonary congestion in which

¹ Zeitschrift f. klinische Medizin, 1894, xxiv, 230.

² Journal of the Infectious Diseases, September, 1916, p. 416.

³ Bulletin de l'Académie de médecine, February 15, 1916, p. 196.

the paratyphoid A was found. This was supposed to be a direct contagion from a neighboring patient. The third type was a chronic pulmonary congestion of which there were two examples, one showing the paratyphoid A, and one the paratyphoid B. There was progressive emaciation, the condition suggesting chronic tuberculosis, but the patients were eventually cured after several months in the hospital. The fourth type was the congestion of the apex of the lung, simulating tuberculosis and progressed with an extremely slow evolution.

Pyorrhea Alveolaris. For several years this disease has received special attention with the announcement that it could be cured by hypodermic injections of *emetine hydrochloride* and by the use of ipecac locally. This method of treatment followed the statements that in pyorrhea the *Endameba buccalis* or other forms of ameba were found. The early reports were extremely favorable, but the later studies have shown that this method of treatment is not all that could be desired. In the first place, in about 98 per cent. of all persons who showed the endameba in the mouth, they may be removed either by the use of ipecac locally or by the injection of emetine hypodermically. But, if nothing further is done, at the expiration of about two weeks' time the organism is again found.

In addition to use of emetine and ipecac, it was found to be imperative to use the older methods of treatment already developed by the dentist, consisting chiefly of scaling off the tartar, and of opening and treating the pus pockets. Ruoff¹ gives a preliminary report of this subject, setting forth the results at the Fort Stanton Sanitarium.

PYORRHEA ALVEOLARIS AND MERCURY. Among the numerous suggestions that have been made in recent years for the treatment of this infection is one which I have previously commented on, namely, the use of *mercuric succinamide*, as suggested by B. L. Wright of the United States Navy. Among the other reports upon the efficiency of this method of treatment is a short one by Copeland.² He reports a series of 12 cases in which not only the local condition was very much improved, but in which the general symptoms, particularly the arthritis which accompanies so many cases, was either greatly relieved or cured entirely. The use of the injections of the drug alone are not sufficient, but must be combined with the usual local treatment by a confident and conscientious dentist. The method used is exceedingly simple. An accurately graduated syringe is necessary, the solutions of the mercuric succinamide are made so that $\frac{1}{5}$ of a grain is dissolved in 4 minims of sterile, distilled water. The injections are made into the buttocks. Injections should be made on alternating sides and should not be too close together. The skin should be sterilized before and after injections by the use of iodine, and the injections are to be repeated

¹ Public Health Reports, January 21, 1916, p. 108.

² Dental Cosmos, February, 1916.

every seventh day. The dose used is generally 1 grain, but this may be diminished or increased 1 or $\frac{2}{5}$ of a grain, according to the size, age and condition of the patient. If salivation is produced, the dose should not be repeated until this condition has entirely passed off, and then a very much smaller dose should be used.

Rabies. PARALYSIS DURING THE PASTEUR ANTIRABIC TREATMENT. Last year I commented on this subject, with particular reference to Hasseltine's report of 2 cases. This paralysis, which occurs in individuals who have undergone the preventive treatment for rabies, is about the only drawback there is to the Pasteur treatment. Fielder¹ has contributed an article on this subject with a report of 7 personal cases and 6 other previously unreported cases. This brings the total number of cases reported up to date to 142 cases, with 24 deaths. It is, however, quite certain that many cases have escaped being reported, particularly mild ones, so that the mortality of 16.2 per cent. is probably too high.

The *etiology* of this curious condition has not been definitely established. Some believe that it is due to anaphylaxis from repeated injections of foreign protein as contained in the rabbit cord used in the treatment.

Another opinion, held particularly by Remlinger and Babes, is that the paralysis is due to the specific virus which is in combination with the fixed virus used for treatment, and that this, together with an idiosyncrasy on the part of the patient, is responsible for the symptoms. A third view is that of Joseph Koch who believes that the paralysis is really the result of a street virus infection received by the biting animal and so modified by treatment that the disease runs a typical and mild course, ending in recovery. There are several facts against this view, as a number of cases have occurred in which the biting animal was not rabid, and still others in which the patients were not bitten. There is no pain, as a rule, at the site of injury and the period of incubation is usually too short for the infection with street virus. In animals the paralytic form is regarded as the severe, and not the attenuated, form of the disease. The last view is that the paralysis is due to the lesions caused by a fixed-virus infection as due to the treatment. Against this is the unusually early appearance of symptoms in some cases and also that if the fixed virus possessed virulence, paralysis would be a frequent occurrence among the persons treated every year, whereas, as is well known, it is rarely seen. Kozewalow holds that a fixed-virus infection is responsible for most instances of paralysis and backs up his opinion with his own experience with several fatal cases, one of his own and several others. In his own case, the patient died with symptoms of an ascending paralysis. No Negri bodies were found in the patient's brain. Animal tests comprised 33 rabbits inoculated with material from the brain, and, of these, 24 died of rabies after an incubation of from six to

¹ Journal of the American Medical Association, June 3, 1916, p. 1769.

seven days. The others died of sepsis. He also cites the 5 cases of Bareggi, in which, following treatment, the patient died within a week. Rabbits inoculated with material from their brains showed rabies in from five to six days. He also cites cases by Franca, and of Goldberg and Oszesalski. In the first case the inoculated rabbits developed the disease on the seventh day, and in the second in from seven to eight days. Kozewalow holds that the short incubation period of rabies in the animals in these cases demonstrates that the paralyses are directly due to the fixed-virus infection.

SCHEMES OF PASTEUR TREATMENT USED BY THE NEW YORK CITY HEALTH DEPARTMENT.

Cord dried.	Scheme 1.	Scheme 2.	Scheme 3.
	Jan. 1, 1912, to Aug. 2, 1913.	Aug. 3, 1913, to May 6, 1914.	May 7, 1914, to Mar. 7, 1916.
	Number of injections in 21 days.	Number of injections in 21 days.	Number of injections in 21 days.
Ten days	3	0	0
Nine days	3	0	0
Eight days	1	1	2
Seven days	1	1	2
Six days	1	1	2
Five days	1	2	2
Four days	5	5	9
Three days	5	7	8
Two days	5	8	0
No. of patients treated	1408	811	911
Cases of paralysis	1	6 (1 fatal)	0
Cases of rabies	4	2	4

Fielder has used three different schemes of Pasteur treatment, the full course of each being twenty-one days. The accompanying table shows their comparative strength by indicating the number of injections of each cord. It also shows the number of cases of paralysis and of rabies which occurred in persons treated under each scheme. It will be seen that Scheme 2 is somewhat stronger than Scheme 1, since it contains three more injections of two-day cord, and much stronger than Scheme 3 which contains nothing more active than three-day cords. Scheme 2 is very much like the one employed by the Hygienic Laboratory of the United States Public Health Service, in Washington, and by most of those who produce antirabic vaccine in this country, with the following differences: (1) The amount of cord per dose was only two-thirds as much as that employed in the Washington scheme, and (2) a two-day cord was used instead of a one-day cord on the eighth and twenty-first days of treatment. Fielder's article contains a number of the more recent bibliographic references which will be of particular interest to anyone working on this subject. The previous references will be found in the articles of Simon and of Remlinger.

THE HARRIS METHOD IN ANTIRABIC TREATMENT. The original method of producing immunity in individuals who have been bitten by

rabid animals was to suspend the cords of the rabbits dried from a fixed virus over potassium hydroxide, and keeping them in as even a temperature as possible. Since then a great many different methods have been suggested for altering the infectivity of the virus, and various methods have depended upon the action of chemicals, dilution, or of dialyzing, or by the simultaneous injection of serum or sensitized vaccine. The earliest modification was suggested by Högyes. He diluted the fresh virus and injected increasing quantities from day to day, and his results have been extraordinarily good; even better results have been obtained by the virus dialyzed according to the method of Cummings. This method I reviewed somewhat in detail in *PROGRESSIVE MEDICINE* for March, 1915. Calmette suggested the use of glycerol, and Fermi emulsified the cord in 1 per cent. phenol. The method of sensitizing the virus was suggested by Marie in the Pasteur Institute at Paris, and is described in his experimental study on rabies published in 1909. His results showed an improvement over those obtained at the Institute in earlier years.

Harris¹ has suggested a modification based on some investigations of Shackell on the effect of desiccation *in vacuo* at a low temperature. The earlier experiments are recorded in a joint article with Shackell.² The object of this method is the preserving of fixed virus so that it may be prepared in quantity and always be available for treatment. By using both brain and cord, enough material is obtainable from a single rabbit for 30 complete treatments. The material can be stored until needed, there is no waste, and no unnecessary work is required of the laboratory staff when patients are lacking or very few. He also claims that with this product treatment may be reduced to one-half the original method. Harris described the method of preparation as follows: "Brain and cord, stripped of pia and bloodvessels, are ground in a mortar into a homogeneous, thick, paste-like mass; carbon dioxide snow, collected from a tank into a sterile cloth, is added to the paste until freezing is complete and until further grinding reduces the mass to a fine powder. This powder is transferred quickly to a cold beaker and placed in a Schibler's jar which has been submerged in a mixture of salt and ice ($-18^{\circ}\text{C}.$). In the upper part of the jar is a beaker of concentrated sulphuric acid. A vacuum of less than 2 mm. is produced and the powdered brain is kept at $-18^{\circ}\text{C}.$ in the salt and ice until desiccation is complete. A single brain and cord will be completely dehydrated in from thirty-six to forty-eight hours." A more detailed description of the technic may be found in the published papers relating to this method. If the brain and cord have been thoroughly ground, completely frozen and absolutely dried at a temperature not above $-18^{\circ}\text{C}.$, the resulting powder will be almost as infective as the fresh untreated brain and cord. When kept *in vacuo*

¹ Journal of the American Medical Association, September 23, 1916, p. 923.

² American Journal of Physiology, 1909, xxiv, 325.

at 0° C. there is no appreciable loss in infectivity for several months. When kept in an ice-box (8° to 10° C.) for 500 days, this powder is five times as infective as an equal quantity by weight of Pasteur's cord that has dried five days."

The results have been recently confirmed by Poor, Jelnick, and Gibson in the New York City Health Department Laboratories. During the past four years this method has been used in the treatment of patients, and Harris has succeeded in collecting data on 1159 patients, and 359 were his personal observations and the others by different observers throughout the country. One patient died during the treatment, and one fourteen days after the first injection, but with these two exceptions there were no deaths and no cases of paralysis. Applying the same rules that are used in the Pasteur Institute, these 2 deaths would not be counted against the treatment, inasmuch as they occurred before immunity could be established. The following table shows the character of the wound in 937 patients, 319 being treated by Harris in St. Louis, and 618 by Couret in New Orleans.

	Head.	Hand and forearm.	Body and lower extremity.	Contact.	Total.
Rabid	40	209	124	98	471
Probably rabid	25	159	95	..	279
Unknown	7	61	67	1	136
Probably not rabid	6	28	17	..	51
Total . . . . .	..	...	...	..	937

The minimal infective dose of the brain and cord is $\frac{1}{250}$ of a milligram, and one can easily inject many times the total infective doses usually contained in Pasteur's scheme with a much smaller proportion of foreign nerve material. Harris suggested 500 units at the first injection, 1000 at the second, 2500 each at the fifth, sixth and seventh. In severe cases the daily dose after the fourth injection may be 3000. The usual mild cases are treated in six or seven days. Mildly injured persons have been given from 7000 to 10,000 units; dangerously bitten persons have received 30,000 to 70,000 units, or twenty times more than that given by Pasteur.

Rat-bite Fever. THE CAUSE OF RAT-BITE FEVER. In PROGRESSIVE MEDICINE of last year I gave quite an extensive review of the facts known about this curious disease. Since then there has been a short publication from the Imperial Japanese Institute for Infectious Diseases, Tokyo, by Futaki, Takaki, Taniguchi, and Osumi.¹ Their observations are based on 4 cases of the disease, on 2 of which they were able to make systematic studies. The incubation period varies from 10 to 27 days, and the disease usually starts with chills, fever, headache, and malaise.

¹ Journal of Experimental Medicine, February 1, 1916, p. 249.

In addition, there is swelling of the lymph nodes, pains in the affected side, and various dark red eruptions. The bite, which has apparently healed, becomes inflamed. The local and general manifestations continue for from three to seven days, followed by an interval without fever for several days, and this continues over varying lengths of time.

Further observations are being made which will be reported at a subsequent date.

In 1914 Schottmüller¹ isolated a streptothrix which he named *Streptothrix muris ratti*. He succeeded in isolating this in eight successive blood cultures in a single case of the disease. He was also successful in getting a pure culture of a somewhat similar organism from a case of the disease following the bite of a South African squirrel.

More recently, Blake² isolated a pure culture of an organism similar to that of Schottmüller. He obtained this *postmortem* from the heart's blood and also from the diseased mitral valve. The organism consisted of branching filaments of different lengths with a strong tendency to fragment into bacillus-like and coccus-like forms. The filaments are either straight or very much curved, and are negative, or faintly positive, to Gram's stain.

Tileston³ had occasion to study a case of the disease which came under his observation and he discovered thread-like organisms by examining fresh smears of blood taken at the height of the fever. These were demonstrated in each paroxysm of fever in his case until the febrile condition ceased. These organisms were from 9 to 20 mikrons, non-motile, some straight or curved and others doubly curved. Some of these resembled a chain of various sizes. Between the paroxysms, no organisms could be found. The dry smears stained with gentian, methylene blue and Leishman's stain gave unsatisfactory results and with these dyes only short bacillus-like forms could be found. Several long filaments were demonstrated, however, with the use of iron hematoxylin. The stained smears, when compared with the organisms isolated by Blake, showed a very striking resemblance. Tileston, however, was not able to grow the organism, although ascitic bouillon and Löffler's blood serum were used. He was unable to produce the disease in brown rats, rabbits, and guinea-pigs, but the inoculations were not made at the time when the organisms were most numerous.

In connection with this disease Tunnickliff⁴ has made some studies on the bronchopneumonia of rats which are of very great interest. Bronchopneumonia is frequent in the white rat, and also occurs in the gray rat. The studies in question were made upon 60 white rats which showed either acute or chronic bronchopneumonia. From 20 of these cases a

¹ Dermatologische Wochenschrift, 1914, lviii, Ergänzungsheft, p. 77.

² Journal of Experimental Medicine, 1916, p. 39.

³ Journal of the American Medical Association, April 1, 1916, p. 996.

⁴ Ibid., May 20, 1916, p. 1606.

streptothrix was grown and isolated in pure culture 13 times. Cultures from 33 rats remained sterile. The nature of the lesions from which the cultures were taken did not seem to bear any relationship, whether the organisms were grown or not, and why some cultures were successful and others negative was not determined. Various other organisms were isolated, some from rats showing the streptothrix and some in which it could not be cultivated. These organisms included streptococcus, pneumococcus, diphtheroid bacilli, and anaërobic spirilla. The streptothrix could not be determined in any one of 24 normal rats on which the examination was made. Young healthy rats injected intraperitoneally with cultures showed acute lesions in the lungs. The organism shows the same characteristics as the *Streptothrix muris ratti* which has been isolated in pure culture from the blood of patients with rat-bite fever by Schottmüller and Blake, and seen in the blood during paroxysms by Tileston. As far as can be determined rats have not been examined for the spirochete described by Futaki.

Rocky Mountain Spotted Fever. Fricks¹ has continued the studies of this subject in connection with the field campaign conducted by the Public Health Service for the purpose of ascertaining the measures best adapted to the eradication of the disease from a community and for determining the present areas of infection in the Rocky Mountain region. He has issued a preliminary report in which he states that all attempts made to cultivate the virus on many different media aërobically have failed, despite the fact that the virus circulates freely in the blood stream, 0.1 c.c. of blood frequently being sufficient to infect a guinea-pig. The previous attempts to grow the virus anaërobically show, occasionally, growths of diphtheroid bacilli, but these were found non-pathogenic for guinea-pigs. Following the announcement of the discovery of the bacillus of typhus fever by Plotz, a more careful study of the cultures has been made and he succeeded in isolating ten strains of these anaërobic bacilli. The organisms so found are not pathogenic to guinea-pigs and did not show complement-fixation with immune serums when used as antigen. The macroscopic method of agglutination was, however, easily demonstrated. These organisms resemble very closely, morphologically and culturally, the strains recovered from typhus guinea-pigs by Hasseltine and Neill.

An endeavor was then made to cultivate the media under lessened oxygen pressures. The first cultures were examined microscopically, but this method was so laborious that it was decided to depend entirely upon animal inoculations followed by immunity tests in order to determine, if possible, the presence of the living virus in the cultures. The cultures tested were from two days to one month old, the majority being less than two weeks old. All of the guinea-pigs injected with cultures

¹ Public Health Reports, March 3, 1916, p. 516.

less than two weeks old, when given the immunity tests later, developed spotted fever. Three guinea-pigs, out of 10 inoculated with cultures twenty-one to twenty-five days old, either showed definite lesions of spotted fever or were immune to the virus. Inasmuch as the spotted fever virus ordinarily dies within twenty-four to forty-eight hours when kept at a temperature of 37° C., as the dosage of the cultures injected was much less than the minimum infective dose of fresh virus, and as in the inoculation of several hundred guinea-pigs no naturally immune pig has been encountered, it seems reasonable to conclude that a multiplication of the virus occurred in the cultures. Fricks also describes the microscopic examination of the blood from animals with Rocky Mountain fever, and has frequently found in preparations obtained by the Giemsa stain extracorpuseular granules stained bright red and highly refractile, also similar bodies within or in close proximity to the red blood cells. The presence of these granules has been considered significant, but it has been difficult to differentiate them with the granules sometimes found in normal blood. They may be demonstrated more easily by dilution and occasionally by centrifugalizing the blood.

Wolbach¹ has a preliminary report on the organism found in connection with this disease.

Up to the present time, attempts at cultivation have failed. Wolbach's work was done on infected ticks, but he hopes to verify his observations further by studies of human cases of the disease.

Anyone interested in this disease will do well to read the résumé of Michie and Parsons.² They have given a short account of the disease, including the little that is known about its history, and also a bibliography of the more important contributions. The blood examinations which they made are of particular interest.

Scarlet Fever. THE EPIDEMIOLOGY OF SCARLET FEVER. This subject has been studied by Donnally,³ with particular reference to the morbidity and the fatality. His study was based upon figures obtained from board of health notifications of cases and deaths from various parts of the United States, Canada, Germany, France, Norway, England and Wales. A careful study of the figures does not show any periodicity in the epidemics of this disease, and the morbidity and mortality rates seem to be independent of each other. For the period studied, there does not seem to have been any striking reduction in the total number of cases as the number fluctuates from year to year with essentially the same limits now as years ago. The smaller the place, the greater the annual fluctuation in the mortality rates. While there has been no decrease in the number of cases, there has been a decrease in the fatality. Lowering of the fatality, however, is not uniform over the entire world. In

¹ Journal of Medical Research, March, 1916, p. 121.

² Medical Record, February 12, 1916, p. 265.

³ American Journal of Diseases of Children, September, 1916, p. 205.

Russia it is probably double the amount that it was twenty years ago, and Japan likewise has a decided tendency toward increase. The epidemics show great variations in their virulence. Some very large epidemics have a very low case fatality, and, on the other hand, a smaller epidemic may be attended with a high fatality. The cause for these variations, which are numerous, are at the present time unknown. The height of an epidemic in this disease may occur at any season of the year, but the largest number of cases usually fall in January and December, and the smallest in August and September, but there are exceptions to this, and in Paris the largest number of cases is constantly in early summer. Roughly speaking, the susceptibility of the sexes is about equal, but there is a slight difference, the males being a trifle more susceptible than females. A number of deaths from scarlet fever is both absolutely and relatively greater in boys than in girls, the deaths in boys ranging from 50.5 to 53.7 per cent. Nearly one-half the cases occur in children at the ages of three, four, five, six, and seven years, and are quite evenly distributed at about 10 per cent. in each of these years. About 90 per cent. of cases occur in children under fifteen years of age, and the disease is one which is peculiar to childhood, but comparatively few adults exposed to the disease taking it. The greatest number of deaths occur in early infancy, varying between 12 to 20 out of each 100 cases. It diminishes with each succeeding year until between the ages of ten and fourteen years when it is lowest, being in the neighborhood of 1 per cent. From this age the disease has a slowly decreasing death-rate.

THE ETIOLOGY OF SCARLET FEVER. There have been a great many studies made of scarlet fever and a great many different organisms have been described, but one can state with definiteness that the streptococcus ordinarily found is to be regarded as a secondary invader and is not primarily responsible for the disease.

A preliminary report on the etiology of scarlet fever is made by Mallory and Medlar,¹ in which they describe a Gram-positive organism found in the postmortem examination of a child dying from scarlet fever on the second day following the appearance of the skin eruption.

IMMUNE REACTIONS IN SCARLET FEVER. George F. and Gladys R. Dick,² have made some studies on the reactions in scarlet fever. In their first report the complement-fixation test, with the blood serum, spleen and lymph glands used as an antigen, failed to indicate the presence of a specific virus, but, with mucus from a scarlatinal angina as antigen, a weakly positive reaction was obtained in one instance. On the supposition that the antigenic property of the mucus was due to a microörganism capable of growth, cultures were made of the mucus and tested as to antigenic properties by means of complement-fixation and

¹ Journal of Medical Research, March, 1916, p. 127.

² Journal of Infectious Diseases, October, 1916, pp. 175 and 638.

intracutaneous reactions. The cultures were made in milk, inasmuch as there is some evidence that the disease may be transmitted through this medium. Two different antigens from scarlatinal growths were used, and one as a control made from a case of Ludwig's angina. Twenty-two cases were tested with the first scarlet fever antigen. Fixation occurred in 12 cases. The second antigen was used in 4 cases, 3 of which reacted positively. The antigen from the Ludwig angina gave positive reactions in one-third of the cases in which it was tried. Various other organisms were also tried, but the only organism tested which appears to produce scarlet fever with constancy is the streptococcus. From the stand-point of using this test as a means of making a diagnosis of scarlet fever in its present form it is, of course, impossible, yet further studies along this line may result in securing a satisfactory test for scarlet fever, a thing which is highly desirable.

The same antigens were used in cutaneous tests on convalescent scarlet fever patients and in test controls diphtheria patients were used, but gave no reaction to scarlet fever. The technic used was similar to that of the Schick test. The von Pirquet scarification technic was tried, but was found to be unsatisfactory. In 12 scarlet fever patients a reddening and induration occurred which reached its maximum on the day after the injection, then gradually disappeared. The control showed much less marked reactions. There were some variations in the reactions to the different types of antigen used. One was a scarlatinal throat antigen, one was a streptococcus, and one was from a case of tonsillitis. The results from these tests are not satisfactory from a practical stand-point and further efforts will have to be made to determine whether it is possible to develop a diagnostic technic along this line.

THE SEQUELÆ OF SCARLET FEVER. An interesting study has been made of the sequelæ of scarlet fever by Dublin,¹ a statistician of the Metropolitan Life Insurance Co., of New York. The study was based on 1153 cases of scarlet fever taken from the records of the Visiting Nurse Service of the insurance company just mentioned. Nearly 82 per cent. of the cases were among children of from two to ten years. The company has no policy holders in the first year of life, so that cases occurring in that time would not find their way into the records. 55.2 per cent. of the cases occurred between three and seven years of age, and after fifteen years of age the disease but rarely occurs, only 6.9 per cent. of the cases referred to coming after that age. These figures are similar to those of other observers. There is apparently no variation in regard to sex. As a general rule, the younger the child the more susceptible to the disease (after the first year of life) and the severer the form of the disease.

There were 90 deaths in the total number, or a death-rate of 7.8

¹ Journal of the American Medical Association, May 27, 1916, p. 1667.

per cent. During the second year of life 15.5 per cent. mortality occurred and in the third year 12.12 per cent. Between the ages of two to ten, the rate was 8.82, and between the ages of two to five the rate was 10.14. After that age the death-rate decreases with the age. In the 90 cases that died, there were complications of some sort in 62 cases. There was kidney involvement in 11 of these, heart conditions in 7, pneumonia in 13, meningitis in 4, and 1 case of otitis media. In 9 cases the disease was complicated with some other acute infection like diphtheria or measles. Among the survivors there were 31 cases of nephritis, 31 cases of otitis media, 22 cases of adenitis, and 11 cases of pneumonia. These figures are somewhat doubtful, as it is possible in the non-fatal cases the complications are not stated as fully as they might have been, and these figures are below those of other sources of information. The survivors were under observation for a period of 3.4 years each. Based on the mortality experienced by the company, the number of deaths to be expected was 18.6. The actual experience was 18 deaths. Instead of showing a higher mortality, as was the case in typhoid fever, the death-rate therefore was almost identical with the expectation rate. Of these 18 deaths, 3 showed a record of endocarditis, and there were 5 deaths from respiratory diseases and 4 from tuberculosis. The others were scattered among various causes of no particular interest, as they had no bearing upon scarlet fever. Curiously enough, there were no deaths from nephritis. The absence of death from kidney disease probably means that the kidney involvement is sufficiently severe to cause death at the time of the disease, so that, if the patient survives, the injury done to the kidney is not sufficiently great to kill within the next five years. It is very probable that after a greater lapse of time there may be a greater number of deaths from kidney lesions. The company in question hopes to clear up this point by subsequent studies made at a later date.

PREVENTIVE VACCINATION IN SCARLET FEVER. In 1914 Caronia made some researches on the scales from persons who had had scarlet fever and who were desquamating, and he was of the opinion that these scales contained a specific antigen. Using an extract made from them, guinea-pig complement, and the serum from the scarlet fever patient, he was able to get a complement-reaction. Since then Di Cristina¹ has made some studies to determine whether this extract might not be used to render children immune. He prepared a vaccine, using 15 c.c. of convalescent serum, and 10 gm. of desquamated scales of skin and added to this 0.8 per cent. of phenol and 1 c.c. of the guinea-pig complement. This was incubated for fifteen hours at a temperature of 37° C. The serum was drawn off and cleared by means of the centrifuge. One cubic centimeter of this vaccine was injected subcutaneously every second day,

¹ *Pediatrics*, Naples, July, 1916, xxiv, No. 7, p. 385.

and after the second or third injection the complement-deviation could be obtained. Ten children who had never had scarlet fever were treated by this method. Seven children between the ages of two and five, were casually exposed to the disease without getting it, and some of these children were left in the scarlet fever ward for several days. Some of the children had been placed in the scarlet fever ward by mistake, and were vaccinated after twenty-four hours' contact with the disease. They were in contact with the cases, sleeping with patients with the eruption, and in the desquamating stage, but none of the children who were vaccinated showed any signs of the disease.

Whether these observations will bear the test of further study cannot be determined at this time, but it suggests what might prove a very fertile field for research.

THE TREATMENT OF SCARLET FEVER WITH FRESH BLOOD FROM CONVALESCENT PATIENTS. In 1896 Weissbecker suggested the treatment of scarlet fever with serum from convalescents. He tried it in several cases without any particular results. In 1902 von Leyden, Huber, and Blumenthal treated 16 cases and were favorably impressed with the results. Subsequently, in 1912, Reiss and Jungmann were more successful, and they suggested the use of from 40 to 100 c.c. of convalescent serum taken from convalescent patients. This work was noted in *PROGRESSIVE MEDICINE* for March, 1913. More recently, Koch, has reported favorable results in 22 cases. In the early uncomplicated cases treated by this method there is a definite drop in the temperature following the injection, but no effect is noted on septic complications such as occur in the throat, joints or lymph nodes. Zingher¹ has suggested a method of using the whole blood and injecting it into the muscles. This method was originally described by him² in 1914. The blood obtained from the donor may be injected directly, or it may be previously citrated by adding an ounce of blood to 1 c.c. of a 10 per cent. solution of sodium citrate, making the final dilution of the citrate 0.33 per cent. A syringe of the blood is injected in each of the following places: the gluteal regions, the outer regions of the thighs, the calves, and the triceps muscles. Four ounces of blood can easily be injected into a young child, and eight ounces into an older child or adult. The blood is obtained by using a one-ounce Record syringe and a platinum needle, number 18-gauge. An ounce of blood is aspirated from the donor; the syringe is then detached from the needle and its contents rapidly injected into the muscle of the patient. To keep the needle in the donor's vein free of blood the assistant attaches a smaller syringe containing some saline or a 1 per cent. solution of sodium citrate. The procedure is repeated until the required amount of blood is aspirated and injected.

¹ New York State Journal of Medicine, March, 1916, p. 112.

² Archives of Pediatrics, December, 1914.

The procedure takes less than ten minutes, and some 4 to 8 ounces of blood may be thus transferred. A large syringe may be rinsed out during and after the procedure, if necessary, in a 1 per cent. solution of sodium citrate. As a rule there is no local irritation and the blood is rapidly absorbed; in twenty-four hours the muscles into which the blood has been injected have resumed their normal condition. Fourteen toxic cases were treated in this manner, these representing the severe cases of a total of some 650 cases. The majority were very toxic and often delirious. The prognosis as a rule was poor. The blood was obtained from the donors who were convalescent from two to six weeks, and the amount injected varied from 75 c.c. to 250 c.c., and in one-half the cases the blood was citrated. Out of the 14 cases, 4 died. The fatal cases were a child of three years with a gangrenous lesion in the tonsils and pharynx; a baby, aged twenty months, practically moribund, and injected on the fifth day of the disease; a child of three and a half with an extensive gangrene of both tonsils; and a man of twenty-five, injected on the fourth day and practically moribund at the time the blood was injected. Of the remaining 10 patients, the injection seemed to exert a very definite influence over the patients. The temperature began to decline within two to four hours after the injection, and in from nine to fourteen hours reached its lowest point. In some cases there was a rise in temperature immediately after the injection, but this was only transitory. If secondary septic complications were present, the temperature went up again after the initial fall and sometimes persisted for some days. The pulse became stronger, steadier and slower, and the cardiac symptoms and cyanosis improved. The respiration became more normal and there was considerable improvement in the mental condition. The rash faded rapidly.

Of 4 cases treated with fresh normal blood, all of which represented the worst type of septic scarlet fever, similar results were obtained. It is possible that this method may also be used to advantage in erysipelas and other diseases, and Zingher reports one instance of this with striking results. In scarlet fever hospitals this method should be easy of application, inasmuch as a list of suitable donors could be kept and summoned in case of need, as the results seem to be very much better if perfectly fresh blood is used than after it is allowed to stand.

Sporotrichosis of the Bones. I¹ have commented several times on the occurrence of sporotrichosis in America. The disease ordinarily occurs as a localized lesion followed by the involvement of the lymph vessels and nodes, or in the form of disseminated lesions characterized by multiple nodules distributed without systematic arrangement throughout the body, or else in the form of multiple ulcerations sometimes suggestive of furunculosis and at other times suggestive of tuberculosis

¹ *Progressive Medicine*, March, 1913, p. 202; 1915, p. 240.

or syphilis. In addition to these extracutaneous forms of sporotrichosis, others have been described on the mucous membrane, muscles, bones, joints, etc.

A recent study on the disease as it occurs in the bones has been contributed by D'Agata.¹ His article also contains a number of bibliographical references, more particularly from French sources.

Sprue and Moniliasis. Last year I called attention to the work of Ashford in reference to monilia in connection with this disease. In another communication he² deals with his observations of the same organism in animals. For the present he suggests that the organism be called *Monilia X*, and he believes this to be a new species which he has recovered from nearly 100 cases of sprue, and separated from other cases by careful cultural and morphological investigations. This organism is evidently of low virulence, but may infect other laboratory animals by hypodermic inoculation. The organism that has been recovered from a patient with the disease, when injected promptly into certain laboratory animals, generally causes their rapid death from mycotic septicemia. If, however, the organism is grown for some time and frequently transplanted, the virulence is only partially or completely lost. These organisms that have lost their virulence may be recovered by passage through susceptible animals, and the virulence may reach such a point as to sicken or kill these animals by continued feeding. In ordinary circumstances, *Monilia X*, when first isolated from a patient will not infect animals by mere feeding. The symptoms produced in such animals depends largely upon the part of the intestinal tract affected, and a certain number infected by feeding died of monilia septicemia, which Ashford believes to be due to a primary pneumonia with a secondary septicemia. The other animals died more slowly from what seemed to be a toxin developed in the intestinal tract from a localization of these monilia. In 2 cases he has succeeded in producing stomatitis and in other cases produced a severe and long-continued diarrhea. When the organism localizes in the skin, typical blastomycotic ulcers are formed whose characteristic is necrosis without pus formation, and, when the internal organs are attacked, large colonies are seen which resemble an embolus.

Tetanus. **MAGNESIUM SULPHATE IN TETANUS.** Meltzer³ has given a short résumé of his studies on magnesium salts. It will be remembered that with Auer, and other associates, he has made a number of contributions on the subject of the action of magnesium on the animal body. He believes that all living functions are continually controlled by two opposing forces, augmentation or action on the one hand, and inhibition on the other. Taking motion as an instance, the maximum effect of the

¹ Il Policlinico Sezione Chirurgica, January 15, 1916, p. 1.

² American Journal of the Medical Sciences, April, 1916, p. 520.

³ Journal of the American Medical Association, March 25, 1916, p. 931.

action factor in a living body is tetanus, and the maximum effect of inhibition is complete relaxation.

After a long experimental study, Meltzer has come to the conclusion that the dominant action of the magnesium salts on the living body, no matter how administered, consists in depression or inhibition. He found, in studying various salts by intracerebral injections, that almost all caused a more or less intense convulsive attack. On the other hand, a solution of 5 per cent. magnesium sulphate caused the animal to pass into a stuporous condition in which it would remain for several hours.

He also found that after the administration of a very small amount of magnesium sulphate injected intramuscularly produces a profound anesthesia which can be maintained for several hours. The consciousness was first abolished and with this there was, as a rule, marked muscular relaxation, while all of the reflexes remain nearly unaffected. After large doses of magnesium are given, reflexes, too, begin to disappear and with a still larger dose the nerve endings become paralyzed while at the same time there is a profound central action. The effect of magnesium salts was studied extensively by intravenous, intraspinal, intramuscular and subcutaneous injections. In all, the effect is of an inhibitory nature. The intravenous effect is rapid and great care must be exercised to guard against possible harmful incidents. Given intraspinally the effect sets in fairly early and may last even longer than twenty-four hours. Intramuscular injections also have a fairly early effect, but are of comparatively short duration. Subcutaneous injections act more slowly, but have a cumulative effect.

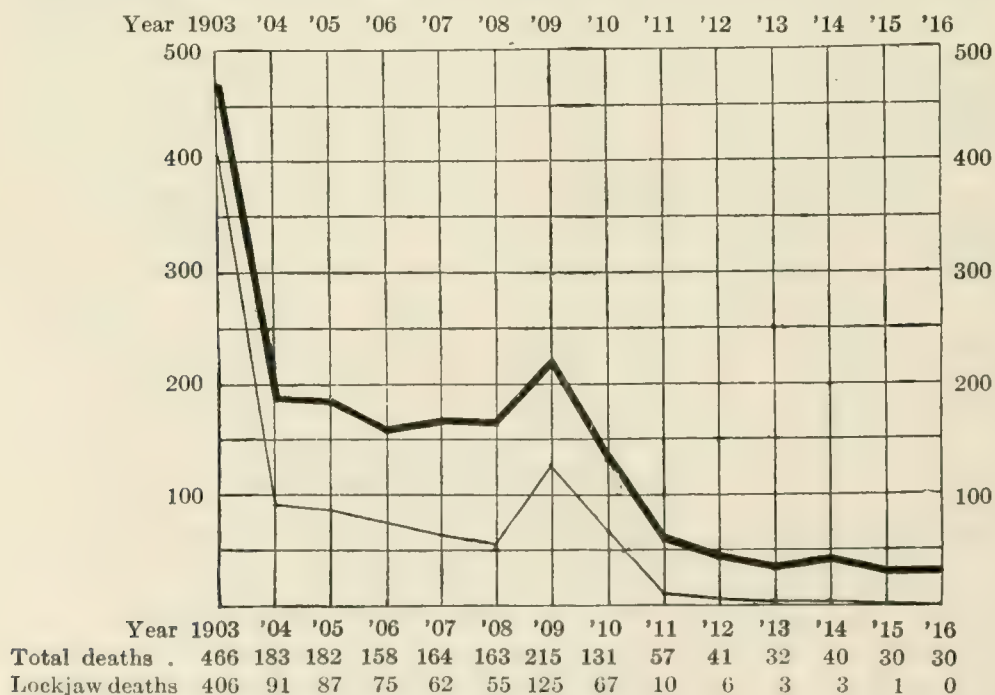
Meltzer believes that many of the cases of tetanus that have been treated by the use of magnesium sulphate and which have been reported in the literature were under the care of individuals who were not familiar with the physiological principles underlying this treatment, nor with the indications or contra-indications, and that some of the conclusions derived from their observations were hastily drawn and without proper criticism. There are certain advanced and dangerous forms of tetanus that cannot be cured or even relieved by any method of treatment. The failure of magnesium sulphate in such cases should not be allowed to militate against the use of the drug in other cases. The use of magnesium in no way interferes with the simultaneous treatment with antitetanic serum. Meltzer believes that magnesium sulphate, if properly used, is capable of relieving severe symptoms better than any other remedy. It is also necessary to know about magnesium salts and what may be expected from their use, and the possible dangers. The magnesium may bring about a temporary paralysis of the respiration. The salt may also cause a temporary appearance of hyaline casts in the urine which disappear after a short time. Intravenous injections of magnesium sulphate may cause a considerable hyperglycemia with only a mild glucosuria. This is also only a temporary thing, and does not interfere with the use

of the drug. The methods of administration, and the indications are fully described and anyone specially interested will do well to read his original article.

Another report dealing with the same subject has been made by Robertson.¹ In this connection one may also mention two other articles of Robertson's² dealing with the prophylactic treatment by means of the antitoxin and the treatment of the developed disease. All three of these articles have a certain amount of interest, inasmuch as they give some of the facts in connection with tetanus in the present European war. Robertson gives in some detail a résumé of contributions on this subject, and tabulates the cases of tetanus treated by intraspinal injections of magnesium sulphate, as well as the cases treated by other methods, subcutaneous and intravenous. Anyone interested in this subject will do well to consult the original article. The reports from the European war are exceedingly variable, some of the authors being decidedly against the use of the drug and others very much in favor of it. As Meltzer has suggested, probably many of the untoward effects of its use are due to lack of knowledge of how to use it, so that even the uncertain results obtained need not militate against the further use of this drug in the treatment of the disease. Of course, the final judgment of any method of treatment depends on its successful application in the actual treatment of the disease, but until the technic is more carefully followed, failures should not be entirely counted up against the method.

TOTAL DEATHS FROM FIREWORKS.

The heavy line shows the annual fluctuation in the total number of deaths since 1903. The deaths from lockjaw are indicated by the light line.



¹ Archives of Internal Medicine, May 15, 1916, p. 677.

² American Journal of the Medical Sciences, May and June, 1916, pp. 668 and 811.

FOURTH OF JULY TETANUS. The annual résumé of Fourth of July injuries, collected by the American Medical Association,¹ showed a total absence of tetanus. A few cases were reported in which it was feared lockjaw would develop, but the prompt use of antitoxin as a prophylactic probably prevented it. The statistics have been collected since 1903, in which year there were 417 cases of tetanus. This has steadily diminished with the exception of the year 1909, when there were 150 cases. In 1912 there were 7 cases, in 1913 there were 4 cases, in 1914, 3, in 1915 but 1, and in 1916 not a single case.

Trichinosis and Serum Therapy. Sulzer² has presented a summary of his findings in an epidemic of trichinosis which occurred at Far Rockaway, N. Y. He presents 35 observations, of which, except the first 6, he claims to be new. The first 6 observations showed that the Kernig sign and edema of the face were present in all cases. Edema of the legs occurred in 6 cases. The reflex of the legs was abolished in every instance and were still present six months after the case came under observation. Trichinae were found in the blood in 9 cases out of 14, and in the cerebrospinal fluid in 8. The observations which he claims are original are that the diazo reaction was in direct proportion to the degree of eosinophilia, that the leukocytosis diminished as the eosinophilia increased, and that the coagulation time of the blood is very markedly prolonged. Trichinae were not found in the urine in any instance, but were found in a pleural exudate once, and in 1 case they were still present in a child, aged three years, three months after a clinical recovery had taken place. The organisms were found not in the uterus, but were abundantly present in the placenta. They were also found in large numbers in the milk of a nursing woman, and also in the excised piece of mammary gland. One case, in which they were found, was complicated by furunculosis, and the organisms were present in the furuncle of the external auditory canal, and the disease was reproduced in a rabbit by inoculation of this pus. The observation was made on feces that were clay-colored in every case, and of 5 cases that have remained under observation, they have continued so. The apparent explanation of this is suggested by the reduction of bilirubin by the living trichinae. Clay-colored stools were also observed in a cat which had accidentally eaten a rabbit after trichinosis had been produced. The organisms were found in all of the cases throughout the disease, and in 3 cases in which studies were carried on after recovery. They are easily demonstrated by making stools alkaline and allowing them to stand from twelve to twenty-four hours. On feeding infected meat to animals the eosinophiles appear within five days, and in 1 case 10 per cent. of eosinophiles were found after thirty-six hours. There were no leukocytosis when the eosinophilia first appeared. The injection of normal

¹ Journal of the American Medical Association, August 26, 1916, p. 676.

² Ibid., August 19, 1916, p. 579.

serum had no value in either man or animals, and the same is true of salvarsanized serum and salt solution. The serum from patients who have recovered removed the eosinophilia persisting after recovery in man and animals within forty-eight hours. In animals, the injection of the convalescent serum caused an almost complete prophylactic result. Animals fed with infected meat within twenty-four hours after the administration of the serum may develop a mild form of trichinosis. Animals fed at a period later than this proved to be immune. All of these feeding experiments were controlled. If the immune serum is mixed with infected meat and then fed, the animals do not develop the disease, although the ingestion of the same meat without the serum is invariably followed by the appearance of the disease. In 2 cases of trichinosis in the very active stage of the disease, the use of immune serum appeared to be of very curative value. There was a drop in the temperature within six hours and the eosinophilia showed a considerable drop within the first six hours. There was a secondary rise, and then a return to the figures found in normal blood within twenty-four hours. In rabbits suffering from the disease experimentally produced, the immune serum had a curative effect within twenty-four hours.

These observations, particularly those relating to the treatment of the disease are of extreme importance and will probably result in a satisfactory method of treating the disease, which, up to the present, has been difficult to deal with satisfactorily.

Typhoid Fever. TYPHOIDIN AND THE DIAGNOSIS OF IMMUNITY. Last year I called attention to the work of Gay and Force in their studies of a secondary reaction made with typhoidin and applied after the method of von Pirquet. These studies were of particular interest in view of the fact that it is highly desirable to have some easy clinical method by which the immunity of an individual may be determined. This will be of especial importance in judging whether an individual who has been vaccinated needs revaccination or not, and also in determining whether a previous typhoid has produced a lasting immunity. Gay and Force described the other methods, the shortcomings of which were recognized, and their suggestion, according to them, is more or less reliable in separating the immune persons from the non-immune. Since that time other studies have been made on the subject with larger groups of cases. Using the method of Gay and Force, Kilgore,¹ in applying the typhoidin by means of an abrasion made after the von Pirquet method, studied some 162 individuals. The test was controlled by an application of a similar preparation of the culture medium, that is, glycerin-bouillon, without the typhoid organisms. Kilgore suggests that in place of using the terms "negative," "positive," and "partly positive," that the actual measurements of the areolas only be

¹ Archives of Internal Medicine, January 15, 1916, p. 25.

put down. The measurements were taken by using a machinist's Vernier gauge which enables one to read to 0.1 mm. He believes that the reports will be more intelligible if made with exact readings of the diameters of the reactions. Without going into the details of his studies, it may be stated that in individual cases the test had a high probable error and therefore could not be regarded as conclusive. Using his typhoidin quotient, which is the ratio between the diameter of the areola produced by the typhoidin divided by that of the control, he found that when the typhoidin spot was about one and one-half times diameter of the control after twenty-four hours, that is, with a quotient of 1.40 to 1.50, it has a neutral significance. When the typhoidin reaction is very much greater than the control, immunity to typhoid fever is suggested, and when it is below this value, that is, when the spots approach equal size, non-immunity is suggested.

Of even greater interest is a very careful study made by Austrian and Bloomfield.¹ They used an extract of typhoid bacillus prepared after the method of Gay and Claypole. This preparation is made after the technic employed by Koch in the preparation of "Original Tuberculin;" 250 c.c. of 5 per cent. glycerin broth is inoculated with a strain of typhoid bacillus and incubated for five days. The culture is then reduced without filtration to one-tenth of its original volume by evaporation over an acetone bath at 56° C. for about eight hours. The end-product they called typhoidin. They used control tests of a similar broth concentrated in the same way to an equivalent volume. For purposes of intradermic injection, the original typhoidin solution was precipitated with 20 volumes of alcohol, filtered, and the filtrate, after being washed with absolute alcohol and ether vapor, was dried on porcelain plates in a vacuum over sulphuric acid. For a control, the glycerin broth was similarly treated. Gay and Claypole, in their studies with the intradermal tests, dissolved this solution in phenolated saline solution, but they did not state the exact amount used.

Similar studies were made by Nichols,² using both dermal and intradermal tests. The dermal reaction with Nichols was not very successful. He believed that this was due to the deterioration of the solution. Intradermal tests gave positive results in 75 per cent. of persons who had had typhoid fever, and in 64 per cent. who had never had typhoid fever but had received prophylactic treatment within four years.

Pulay³ carried out a series of tests on individuals who had had typhoid fever, some who had been vaccinated, and some with a negative history, and he apparently confirmed the results of Gay and Force and of Gay and Claypole.

¹ Archives of Internal Medicine, May 15, 1916, p. 663.

² Journal of Experimental Medicine, 1915, xxii, p. 780.

³ Wiener klinische Wochenschrift, 1915, xxviii.

Austrian and Bloomfield have made a very careful study of the intradermic method, using the exact technic of Gay, and what was known as the army strain "Rawlings" typhoid bacillus. In most of the series of observations they used a polyvalent typhoidin prepared in the same way, but representing the combined precipitates of thirty-five strains of the typhoid bacillus. In carrying out the tests, from 0.00001 to 0.02 gm. of typhoidin was used. The solution was injected within two hours of its preparation. In each case a known weighed quantity of typhoidin, dissolved in a constant volume of 0.85 per cent. of salt solution, was injected into the skin of the upper arm or forearm after it had been cleaned with alcohol. At the same time of the typhoidin solution injection, an injection of an equal amount of the control solution was given. The results of the inoculations were noted immediately, after six hours, twenty-four hours, and often at daily intervals for a week. Within a few minutes to one-half hour after the injection, an erythema, 0.5 to 2 cm., developed, in the center of which there was generally a small area of edema. During the next few hours the erythema spread and the central edema subsided, leaving at the site of the injection a slightly elevated indurated nodule, the skin over which was darker than the surrounding area. When small doses, such as 0.00005 gm. or less, of typhoidin were used, the reaction was purely local and reached its maximum within twenty-four hours, when there was generally a small, broad nodule at the site of the puncture surrounded by a zone of erythema that varied in size, but was rarely greater than 5 or 6 cm. in diameter. The color faded during the next twenty-four hours, leaving a small central stain that at times persisted several days or even a week.

When larger amounts of typhoidin were injected, the reaction was similar but greater in extent, and, in addition, any or all of the following signs occasionally developed: Marked local tenderness, heat and swelling; pain when the elbow was flexed, lymphangitis, axillary lymphadenitis, and even slight fever and malaise. Occasionally, the erythema was sharply outlined, but more often it was diffuse and its outlines so difficult to discern that accurate measurements of its extent could not be made.

They used the test on individuals who had had typhoid, on those who had received prophylactic antityphoid vaccination, and on those who had not had either the vaccination or typhoid. Gay and Claypole suggested as a criterion of a positive reaction a difference of 2.5 mm. in the diameter between the areola resulting about the site of the injection, and that developing around the injection site of the control preparation. Tests made in 10 individuals who had had typhoid, using various amounts of typhoidin, all gave a positive reaction, but with identical preparations and procedure carried out in 10 individuals who had never had typhoid fever, and no illness that was probably abortive

typhoid, and no vaccination, they showed similar results. The same was true of a series of 28 persons who had received prophylactic injections from three months to five years previous to the tests. They all reacted positively, but so did a similar number of individuals who had never had typhoid or antityphoid vaccination. In all, 25 persons who had not had typhoid or the vaccinations were tested. From the results of their observations, Austrian and Bloomfield conclude that the typhoid reaction as they used it, failed to differentiate between those who had neither had typhoid and had not received the prophylactic vaccination, and those who had had the disease or been artificially immunized against it.

DUODENAL CULTURES IN TYPHOID FEVER. In 1912 Hess¹ passed a duodenal catheter on a baby twenty-two months old, who was suffering with typhoid fever. This was in the third week of the disease, and he succeeded in drawing a small amount of bile-containing fluid from which typhoid bacilli were cultivated in very large numbers. He suggested that this might be a valuable method of making a diagnosis of typhoid carriers. Subsequently, this procedure was repeated in adults by MacNeal and Chace, and Garbat, using the same technic, recovered the typhoid bacillus from the duodenum of a typhoid carrier. This observer² has made a short report on this subject and given his technic briefly. He believes that this method will be of particular value in determining which typhoid convalescent patients are carriers and which are not, and how long the positive ones remain so.

THE RUSSO REACTION IN TYPHOID. In 1905 Russo described a test which he believed to be diagnostic of typhoid fever. This test has not been used very extensively, although there have been a number of reports made upon it. Kahn and Wechsler³ have made a study of some 758 cases of various diseases, including 35 cases of typhoid. The technic of the test is very simple. The reagent consists of a 0.1 per cent. aqueous solution of methylene blue. Several drops of this reagent are added to a few cubic centimeters of urine. If the reaction is positive, the urine assumes a mint-green or emerald-green, and if any trace of a bluish tinge is present, the reaction is regarded as negative. The test is best made by comparing the color with some form of colorimeter. The positive reaction is not affected by boiling the urine or by the previous ingestion of such substances as phenacetin, salol, quinin, and calomel. They also studied at the same time the urochromogen reaction of Weiss, which is made by using a 1 per cent. aqueous solution of potassium permanganate. The urine is diluted four or five times, and, if it is highly colored, it is diluted still further, and to it are added several drops of the permanganate solution. The

¹ *Journal of Infectious Diseases*, July, 1912, p. 71.

² *Journal of the American Medical Association*, November 18, 1916, p. 1493.

³ *Medical Record*, January 15, 1916, p. 106.

positive reaction is indicated when the urine assumes a distinct yellowish color, which should not be mistaken for a pink or light red color. In addition to this test, the Ehrlich diazo reaction was also made.

There are certain fallacies in the test. It has been pointed out that if the urine contains bilirubin it will give a positive reaction and it is said that in addition to typhoid the test is found positive in measles, smallpox, chronic and suppurative tuberculosis, but that it is negative in varioloid, varicella, scarlet fever, miliary tuberculosis, appendicitis, and malaria. In most cases of typhoid the reaction of Russo appears toward the end of the first week and persists even through convalescence.

Kahn and Wechsler found the Russo test positive in about 60 per cent. of the typhoid fever cases, and in about 10 per cent. in tuberculosis. They also found it in a case of hemophilia, in a case of anemia, and in a case of diabetes, erysipelas, measles, rheumatism, typhus, and pneumonia. With the exception of the empyema, only a very small percentage of cases tested reacted. In the empyema, 4 out of 6 gave a positive reaction. They also found it in 18 out of 115 surgical conditions. In most of these the condition was a fracture or something in which there was exudation and absorption of blood. In these conditions the diazo and Weiss reactions were almost all negative. They believe that the Weiss test is so inconstant as to have no clinical value, but they believe that the Russo test should be adopted in clinical routine work, and, if the urine is positive after both the Russo and diazo tests, it should lend some weight to the positive diagnosis of typhoid.

Typhus Fever. TYPHUS FEVER IN SERBIA AND THE HISTORY OF THE DISEASE. Anyone interested in this subject will do well to read the delightful lectures of Moon,¹ which were delivered at the Royal Society of Medicine, being the Chadwick lectures for 1915. Moon has given an historical account of the relation of typhus fever to military procedures, which cannot be gone into here, but which cannot be passed over without mention.

THE ETIOLOGY OF MEXICAN FEVER. This disease has received considerable attention in the past few years and I have commented in previous years upon the results of the studies that had been made. The announcement of an organism found in cases of European and American typhus by Plotz, Olitsky and Baehr has made it very important to have Mexican typhus (tabardillo) studied by the same methods. A preliminary reference to such studies has been made by Olitsky, Denzer and Husk.² Unfortunately, Husk was claimed as another victim of the students of this disease, dying shortly after his departure for Mexico. The organism found was an obligate anaërobic Gram-positive bacillus, which, in morphology and cultural characteristics, including acid pro-

¹ *Lancet*, May 27, 1916, p. 1070.

² *Journal of the American Medical Association*, May 27, 1916, p. 1692.

duction in various carbohydrates, is typical with the *Bacillus typhi-exanthematici*. The organism from a blood culture injected into a guinea-pig proved to be pathogenic, and the blood of patients when injected into patients gave a characteristic typhus reaction. The agglutination test of serums taken in different stages of the disease showed negative results during the early part of the illness, an occasional positive at or near the crisis, and uniformly positive reactions after the crisis. The same organism was obtained from lice taken from the clothing of typhus fever patients.

These studies were made in February, 1916, in Matchuala, Mexico, and had been interrupted by the necessity of Americans leaving the country.

VACCINATION IN TYPHUS FEVER. Plotz, Olitsky, and Baehr¹ have made a brief report on their work in Bulgaria and Volhynia, in combating typhus fever by means of a vaccine prepared from a *Bacillus typhi-exanthematici*. The vaccine consisted of a suspension of fifteen strains in normal salt solution and this is subjected to a temperature of from 58° C. to 60° C., one-half to one hour. This had been tested as to its sterility, and then diluted so that each c.c. contained about 2,000,000,000 bacteria, and 0.5 per cent. phenol or tricresol added. Three injections, consisting of 0.5, 1, and 1 c.c. respectively, were given with five or six intervals. Without going into the details of their work, one may state that 8420 persons in Serbia, Bulgaria, and Volhynia were vaccinated against typhus fever during the epidemic of 1915 and 1916, an attempt being made to include in this number only the persons who were most exposed to the danger of infection. Of this number, 6 developed the disease during the four months of the epidemic. These results are particularly striking and show pretty conclusively that even if the vaccine does not produce a perfect immunity, it is sufficiently so to recommend the use of the vaccine in combating the spread of the disease.

Acute Myelitis following Varicella. Wharton Smith² has reported a case of acute myelitis following chicken-pox in a white boy, aged seven years, who applied for treatment, complaining of stiff knees.

Acute myelitis may occur after a very large number of infections and it has been produced experimentally by Marinesco and others, by injections of various organisms, chiefly of the staphylococcus or streptococcus groups. The etiology and bacteriology of myelitis is still in its infancy, and whether these cases occurring in the course of infections are due to the primary disease or to secondary infections, it is not possible to state at this time.

Whooping-cough. **THE EPIDEMIOLOGY OF WHOOPING-COUGH.** Another very interesting and important study coming from the Bureau of Labora-

¹ Journal of the American Medical Association, November 25, 1916, p. 1597.

² American Journal of Diseases of Children, December, 1915, p. 445.

tories of the Department of Health of New York City, is a report by Luttinger.¹ The study was brought about by the almost complete lack of data bearing on the epidemiology of the disease in New York City, so in order to obtain the facts, certain special studies were made. In 10,000 cases, 80 per cent. of all patients were under five years of age. The following tables show the incidence according to age, the first in 10,000 cases, the second in 2000 cases:

INCIDENCE OF PERTUSSIS ACCORDING TO AGE, 10,000 CASES.

Age.	Cases.	Percentage.
Under 1 year	1940	19.4
1 year, under 2	2019	20.1
2 years, under 5	4010	40.1
5 years, under 15	1799	17.9
15 years and over	232	2.3

INCIDENCE OF PERTUSSIS ACCORDING TO AGE, 2000 CASES.

Age.	Percentage.
Under 1 year	24.3
1 year, under 2	20.8
2 years, under 5	38.6
5 years, under 15	15.1
15 years and over	1.2

DEATHS ACCORDING TO AGE FOR THE LAST FIFTY YEARS IN THE OLD CITY OF NEW YORK (MANHATTAN AND BRONX).

Age.	Cases.	Percentage.
Under 1 year	8668	50.8
1 year, under 2	4659	27.3
2 years, under 5	3213	18.8
5 years, under 15	471	2.7
15 years, under 25	13	0.3
25 years, under 45	10	
45 years, under 65	8	
65 years and over	4	
Total	17,046	

These figures show that 97 per cent. of all the deaths occurred in patients under five years of age, and that over 50 per cent. of all deaths were in children under one year of age, so it is to be that while the danger of contracting the disease in children under one year of age is relatively slight, the danger of dying from it is extremely great. Children of two years and under five are most liable to become infected, but have the lowest mortality. Those over five and under fifteen, whose liability of infection is less than those under one year, or those of one year and under

¹ American Journal of Diseases of Children, September, 1916, p. 290.

two, show a very low percentage, less than 3 per cent., while all adults show a negligible percentage, 0.3 per cent., although the rate of incidence, which seems to be about only 2 per cent., is very important when one remembers their role of carriers and the tendency of the disease to remain undetected and hence unreported.

The relation of sex is even more remarkable than that of age. Among girls the incidence is greater, and also the mortality is greater. This increased severity is due to the anatomical differences and the construction of the larynx, and possibly to the greater susceptibility of the nervous system of the girl. In adults there is even a much more marked proportion between the sexes, owing probably to the greater exposure of the woman to infection from children, it would not be wise to draw conclusions specifically supporting the sex factor, but the figures of adult infection strongly suggest that the woman is more apt to contract pertussis and more often succumbs to it than the man. This is practically the only infectious disease of children in which the difference in incidence and mortality is particularly noticeable.

One would ordinarily expect the greatest number of cases and the greatest number of deaths to occur in winter when the prevalence of infections of the upper respiratory tract are most common. Curiously enough, the New York survey found that most cases seem to occur in spring and summer, and that the greatest number of cases seem to be in spring. The figures cannot for a number of reasons be compared, as the returns were in one way or another incomplete, but Luttinger believes that the pertussis curve in most years will coincide most nearly with that of diarrheal diseases, rather than that of respiratory infections. The effect which the seasonal variation has on pertussis, as contrasted to its effect on the mortality of scarlet fever, measles, diphtheria, croup and acute bronchitis, shows that the lowest curve in acute bronchitis coincides with the highest point in the curve of pertussis. This suggests that the fatalities in pertussis were probably due to the action of a toxin and not to complicating respiratory infections. The disease seems to be influenced by the surroundings, and children who were suffering from malnutrition and who did not get sufficient fresh air, will whoop longer than children who get plenty of fresh air and are well cared for. Change of air seems to have a very definite influence for good. Of cases seen in private practice very few died, even though there were many respiratory complications such as pneumonia, and this difference in mortality may be largely due to the children getting more fresh air and, if needed, a necessary change of air.

Comparisons of the death-rate of pertussis with the general death-rate show that there has been a steady decrease. The death-rates were compared from 1868 to 1915. Sometimes, as in 1872, the rate per 100,000 of population was 58.32 and the rate was very high, but it has steadily decreased from about 25.5 per 100,000 to about 7, the lowest rate being

in 1908, when 4.71 cases died per 100,000 of the population. This lowering of the death-rate of whooping-cough is very remarkable and compares very favorably with the diphtheria curve. No reason can be assigned for the lessening except the general increase in knowledge and observation of public and personal hygiene.

The disease is very prevalent in New York City, but it is very probable that only about one-tenth of all the cases are reported to the Department of Health. In a disease of this kind the source of infection is extremely important, and, in the majority of cases, it is easily ascertained. The disease is transmitted through direct contact, and, while infection indirectly may occur, it is probably rather rare. In the New York research, out of 1120 homes visited, they found pets in only 26. It does not seem possible to transmit the disease to puppies or rabbits, so that it does not seem possible that these animals are factors in the transmission of the disease, yet in some instances animals are found with cough coincident with pertussis. Only one such case is mentioned in the report in which the dog had been sick for a year and the owner refused to allow cultures to be taken. The dog died two weeks later. The cause of the cough was not ascertained. The table showing the probable source of infection in 2310 cases is given below:

PROBABLE SOURCE OF INFECTION.		Cases.
Neighbor		1311
Relative or friend		204
Playmate		203
School		146
Nursery		76
Moving pictures		62
Recreation pier		18
Roof garden		9
Ferry		8
Street (?)		6
Subway, elevated and street cars		4
Unknown		263
Total		2310

It will be seen that only 60 per cent. of all cases were ascribed to neighbors' children, and playmates and relatives or friends comes next with about 10 per cent. each. The moving picture shows are, perhaps, a main source of infection, although not credited with very many cases in the above statistics. Ninety-four such places were visited from March to December, some in the open air, but mostly closed, and it was unusual not to hear continued coughing and very often paroxysmal coughs. There were 12 children with whooping-cough who were noted in visiting the 94 cinemas, 21 had paroxysmal cough, 35 had cough without paroxysms, and 63 adults were noted with cough.

A considerable number of children seemed to exhibit an apparent

immunity, but probably a certain percentage of these have had mild attacks without very definite paroxysms and without whoop, and so have escaped attention. One attack of the disease apparently confers an immunity, although second attacks may be occasionally noted. It should be borne in mind in this connection that a child who has had a severe whooping-cough will whoop with any sort of respiratory infection for nearly a year later. Luttinger believes that in many instances where it is difficult to trace the source of infection, it is due to either adults or children who are pertussis carriers. These carriers have the disease in an atypical form and hence go unrecognized as pertussis cases.

AGGLUTINATION IN WHOOPING-COUGH. Anyone interested in the laboratory studies of this subject will do well to read the article of Povitsky and Worth.¹ They made studies to determine the best conditions in which agglutinating serum may be obtained on test animals and also on the comparative value of the test in demonstrating specificity of strains isolated from human beings suffering from whooping-cough, and they also tried to add further evidence on the comparative value of complement-fixation and agglutination in the clinical diagnosis of whooping-cough.

This whole subject is one of great practical interest, as much of the value of preventive work in pertussis depends upon the early and accurate diagnosis which cannot always be made by the rougher clinical methods. A great deal more work, however, will be necessary before these laboratory methods will be completely at the disposal of the practitioner.

In regard to the vaccine, Luttinger² states that "as to prophylaxis, while we still lack the absolute proof that pertussis vaccine is a positive prophylactic agent, data are accumulating which strengthen our belief that it acts as such in all patients who are inoculated before any symptoms develop and that in many cases it aborts the disease. Whether such prophylactic cases would have remained free from pertussis even without the administration of the vaccine is a question which cannot be solved in private or dispensary practice."

Weil's Disease. In the western part of Japan there has been present an epidemic disease which is characterized by congestion of the conjunctivæ, muscular pain, fever, jaundice, tendency to hemorrhage and albuminuria. This corresponds exactly with the cases described by Weil³ in 1886. There has been some difference of opinion concerning these cases of epidemic jaundice, some observers believing that they should all be grouped together, or, at any rate, that sufficient evidence does not exist for separating the particular type of disease described by Weil from the others. There is also a difference of opinion as to whether Weil's disease as found in Europe is identical with that which has been

¹ Archives of Internal Medicine, February 15, 1916, p. 279.

² American Journal of Diseases of Children, September, 1916, p. 290.

³ Deutsch. Arch. Clin. Med., xxxiv, 209.

described in Japan. In 1892 Jaeger described a bacillus of the proteus group in a garrison epidemic occurring at Ulm, and this organism which he called the *Bacillus proteus fluorescens*, has been found by other observers and also has been found in the water supply. It is pathogenic for laboratory animals when injected into the veins or peritoneal cavity, but not by feeding cultures. Certain other observers have thought that the disease was due to an organism of the colon group.

More recently some observations have been made in Japan by Inada, Ido, Hoki, Kaneko, and Ito.¹ They propose to substitute the name of *Spirocheta icterohemorrhagicæ* for the various names already in use. They have been able to study the disease in three different parts of Japan and they believe that it is due to a spirochete which is found only in the early stages of the disease in the blood and is present in rather small numbers. At the time that autopsies are made, the liver is either free of spirochetæ or they are so few or so small in form as to be difficult of recognition. In the early studies, searches were made for bacteria in the blood, urine and feces, and, finding nothing, the blood of patients was inoculated into monkeys, rabbits, rats and guinea-pigs. The guinea-pigs developed albuminuria, conjunctival congestion, jaundice and hemorrhages when the blood was injected during the first seven days of the illness. In the guinea-pigs, the spirochetæ multiply freely and were found in very large numbers in the liver. They subsequently found the same spirochete in the specimens of patients' blood, in the intestinal wall in 1 case, and in the adrenal glands of another, out of a total of 11 cases that came for autopsy. These patients had died on the eighth to fourteenth day of the illness when the spirochetæ are already greatly diminished in number.

Previous observations as to an infective agent in the blood have been made by Hecker and Otto and Fiedler and Schittenhelm, but these observers reported only negative results.

Weil believed that the disease described by him was transmitted by taking the organism in through the alimentary canal, whilst Hecker and Otto thought that the infection might be communicated by the bite of some insect, most probably the mosquito. Inada thinks that the infection probably occurs through the alimentary canal, but that it seems probable that the organism might enter through the skin as at times the disease begins with local swelling of the lymph nodes.

Ito and Matsuzaki² have also published an article on the cultivation of this spirochete and they have been able to grow it in solid, semisolid, and fluid media.

Stokes and Ryle³ have made a report upon Weil's disease as seen in the army in Flanders.

Their observations would seem to prove that the disease as seen in Japan and Europe are either the same or very closely related.

¹ Journal of Experimental Medicine, 1916, xxiii, 377.

² Ibid., xxiii, 557.

³ British Medical Journal, September 23, 1916, p. 413.

DISEASES OF CHILDREN.

BY FLOYD M. CRANDALL, M.D.

LAST year I mentioned a peculiar feature marking pediatric literature, due to the small amount of material available from foreign sources. The same conditions are even more marked this year. Surgical subjects and the many phases of military medicine and surgery have occupied so much attention that the diseases of children have received comparatively slight notice. Moreover, the receipt of foreign journals has been largely diminished. Owing to these conditions, the material for the present article has been drawn more than in any previous year from American sources. Another condition has tended to restrict the material available for this article. The epidemic of poliomyelitis has so occupied the attention of writers upon diseases of children, that many journals during the latter portions of the year have been devoted largely to that subject.¹ Much has been written, however, upon pediatrics, and there has been no difficulty in securing what I feel is interesting material for the issue this year.

Infant Mortality. In a carefully prepared paper, Dr. Kate C. Mead,² of Middletown, draws comparisons between the mortality rate of infants in this country and Scandinavia. In the Scandinavian countries the mortality rate of infants has been enormously reduced during recent years. In this country the proportion of saving in child life has been less. Under the investigation of Van Ingen, it was found that the death-rate in the foundling homes of New York State was 422 to the 1000, while the death-rate of the babies of the slums of New York City is hardly more than one-fifth of that number. That the deaths in these homes is unnecessary for the most part is seen by comparison with the death-rate of the foundlings of Sweden, which is only 4 per cent., but there are good reasons for this difference. Sweden has not only hospitals for sick babies, but small boarding houses for well babies, and large asylums for mothers with their babies. By such methods, New York City has cut down its infant death by 17 per cent., in the past five years, that is by boarding 44 per cent. of its foundling babies in small houses where each individual may have a mother's attention, under the supervision of doctors and nurses. For caring for marasmic babies the foster mothers receive \$15 per month, and for healthy babies \$10. In this way the infant mortality was cut in half, at an expense to the public

¹ See article by Dr. Ruhräh in this volume.

² New York Medical Record, August 26, 1916.

treasury of 69 cents per day, whereas the foundling asylums were formerly allowed from \$1 to \$2.29 a day for each inhabitant.

Not only has New York City discovered that Scandinavia has chosen the better way, both financial and sociological, to conserve the babies, but other American cities are trying the same plans. Boston has recently proved that visiting nurses and milk stations afford a very inexpensive means of lowering the death-rate of babies, which was 134 to the 1000 births in 1910, as compared with 99.5 in 1914, a decrease of 25 per cent., with an average of 1132 babies saved every year.

If, as Prof. Irving Fisher has shown, a baby's life is valued at \$1700, this saving to Boston in dollars and cents pays an enormous interest on the salary of its nurses and the up-keep of its milk stations, but the money, however, is as nothing in comparison with the unlimited value to the public of the educational teachings of these nurses in the homes of the badly born and unenlightened. Boston now has third place in the list of first-class cities in the United States in respect to its infant mortality, while Philadelphia is sixth, and in the summer of 1914 Boston lost only 99.4 babies in the 1000 while New York lost 117.

It is probable that the average intelligence of Scandinavian midwives is far superior to that of most of our midwives, who come mainly from eastern and southern Europe, where their training has been inferior to the hospital training of the Scandinavians. Forty per cent. of the children among our foreign population are born under the care of midwives whose only qualifications are that they can read and write in their own language and that they have seen six confinement cases. In England, France, and Germany, where for military reasons a falling birth-rate and increasing infant mortality mean national disaster, midwives are being carefully trained and supervised, for in these countries women have for centuries been considered the natural obstetricians. By this method alone they have lowered their mortality one-third, and if we in the United States should thus deal with our midwife problem, and by so doing lower our infant mortality one-third, we should take third rank instead of fifteenth.

Ustveldt¹ has been compiling data upon infant mortality in families in which there is tuberculosis. The last five years at Christiania such a record has been kept. When such a record has been continued for twenty years, tracing the later fate of infants born into these families, unquestionably valuable lessons can be deduced from it. His material includes 480 infants born in families in which there was one or more tuberculous cases in the contagious stage. An average of 19.2 per cent. of the infants died within the first year of life, while the average infant mortality in the city at large was 10.8 per cent. A number of tables are given for comparison of various data. They testify anew, among

¹ Norsk Magazin for Laegevidenskaben, October, 1916; Journal of American Medical Association, November 11, 1916.

other things, to the dire influence of tuberculosis in the mother and of bottle-feeding. Of the 19.2 per cent. who died within the first year, 40 per cent. had a tuberculous mother; and of the 334 breast-fed children only 10.5 per cent. died, while 28 per cent. of the 128 bottle-fed did not live through the first year. Only 37.1 per cent. of the infants died of actual tuberculosis among the 124 that died during the five years in question.

It is stated that the cool summer and the extreme attention paid to infant welfare have exerted a progressively favorable influence on infant mortality¹ in Berlin. This is especially evident on comparing the mortality for July, 1916, with that for the same month of the year before. In 1916 there were only 210 deaths among infants in July, while in the corresponding month for the preceding year, 1915, the number was 410. These figures represent in 1916 only 11.26 per cent. of the total mortality in contrast to 19.12 per cent. of the year before. The general mortality of Berlin is also lower than it was in July, 1915.

Icterus Neonatorum. After an extended study upon the secretion of bile in icterus neonatorum, Hess,² of New York, concludes that the amount of biliary flow during the first twelve to thirty-six days of life is very scanty, and that, although it then increases in volume, it is subject to wide fluctuations. It is, therefore, inaccurate to depict it graphically, as has been attempted, as a gradual rise dating from the time of birth. The secretion of bile varies within wide limits. In general, it is marked when jaundice is marked. Furthermore, recent investigations of icterus neonatorum seem to confirm the interpretation that the occurrence of jaundice results from a defective correlation of excretion and secretion, and is generally caused by the inability of the rudimentary excretion to cope with the sudden profuse secretion of bile.

Instances of this condition in two families of five and six children respectively, are reported by Abt.³ There was nothing in the history of either family to show the cause of the disease in these infants. Three children of the first family had died, one on the third and two on the fourth day. In the second family, two children had died of icterus on the third day. The last child had had the disease, but had improved on the fifth day and recovered. Abt said that this disease is quite different from the chronic familiar jaundice, in which the patients might live to advanced age. Tileston,⁴ of New Haven, in describing these cases, said that yellow staining of the nuclei of the base of the brain or medulla was never encountered in jaundice in the adult, and that its presence indicates a powerful poisoning. He does not believe familiar icterus to be a septic condition. Sherman⁵ wondered whether these

¹ Deutsche medizinische Wochenschrift, September 28, 1916.

² American Journal of Diseases of Children, April, 1916.

³ New York Medical Journal, September 2, 1916.

⁴ Ibid.

⁵ Ibid.

cases might not be due to the poison of chloroform, which might produce degenerative changes resulting in death some days later.

Lung Capacity of Children. After extended investigations upon this subject by the United States Public Health Service under the general supervision of Surgeon-General Blue,¹ it was concluded that from six to thirteen years old the white boys of the city of X had from 100 to 200 c.c. greater lung capacity (as measured by the dry spirometer) than the girls. From fourteen to seventeen years, the boys have progressively from about 300 to 1100 c.c. greater lung capacity than the girls. Thus the increase in high-school age (athletic age) in the boys is out of all proportion to the increase in primary and grammar-school age. From six to thirteen years, inclusive, the yearly increase in lung capacity of girls in the city of X is very similar to that of the boys, but at fourteen there develops a very distinct decrease of increase, and from fourteen to seventeen years inclusive the annual increase averages distinctly less than that for the years six to thirteen. The decrease of the increase at fourteen years in the girls follows immediately upon the average age of beginning menstruation (13.2 years), and it corresponds with the decrease of the increase in height (sitting and standing) and weight. There is a slight irregularity of the increase curve at eleven in both boys and girls, corresponding to the irregularity found for the same year in the curves for height (sitting and standing) and weight in the boys, and for sitting height in the girls.

In the case of both boys and girls, children from the homes providing better sanitation have a tendency (total, 15 to 9; boys 8 to 4, girls 7 to 5; estimated in year groups) to greater lung capacity than the children from homes with poorer sanitation (total, 9 to 15; boys 4 to 8, girls 5 to 7).

In cases of intestinal affection it was not evident that hook-worms, ascaris, lamblia, or *Endameba coli* had any noticeable effect upon the spirometer tests. While pupils with whip-worm infections showed a preponderance of tests lower than the average, the number of cases is so small that conclusions are doubtful in value.

The Care of Rural School Children. There is little doubt that, in every country, physical efficiency is rare, that is to say, that in the large majority of individuals there exist defects which subtract considerably from the ideal of perfection. That physical imperfections are found is continually being demonstrated by the rejections for army service in all countries. Dr. Taliaferro Clark,² Surgeon, United States Public Health Service, states that only 316 of 11,012 applicants for enlistment in this branch of the public service were up to the required physical standard. The particular point that Clark³ makes is that it has been

¹ Reprint No. 306, Public Health Reports.

² Public Health Reports, October 6, 1916.

³ Editorial, Medical Record, November 18, 1916.

noted by observers in other countries that in the case of volunteers for military service, rejections because of physical imperfections are in direct relation to the number of years spent in school. The writer therefore seems to think there may be some truth in the hypothesis that the schools may be responsible in some measure for such lack of development. He further holds that this view is all the more evident when it is recalled that the greatest number of rejections for enlistment on account of physical imperfections were due to abnormalities of physical development, defective vision and hearing, heart disease, faulty teeth, and postural defects. These defects are to a great extent preventable or at least controllable, depending upon their prompt recognition in childhood, the period in which so many of them have their origin.

In discussing the condition of school children in one county in Indiana, in which investigations were undertaken by the Public Health Service with regard to physical averages, it is pointed out that, as compared with the records of children in most urban centers, the boys were below the average height from the age of six to seventeen years. The girls were under mean height from the age of twelve to seventeen years. The deficiency ranged from 0.7 to 2.4 per cent. among the boys and from 0.2 to 2.8 among the girls. The deficiency of weight from the age of seven to fifteen varied from 0.2 to 5.9 per cent. in the boys and from seven to sixteen in the girls 0.6 to 8.9 per cent. Unsuitable food was found to be the chief cause of this backward development. Moreover, no adequate facilities for play were provided, and no systematic exercises were practised in any of the rural schools of that county.

Ear troubles, impaired vision, and defective teeth were found to be very prevalent. In regard to impaired vision, faulty illumination is held to be largely responsible for the condition, and, in addition to this, a number of rural school children were found to be badly in need of glasses and had never been refracted. It goes without saying that the rural school child is greatly in need of instruction in the care of the teeth and in the need of adequate dental service. It was shown that no fewer than 49, or 3 per cent., of the children of that county had defective teeth, and only 16.9 had dental care. Furthermore, 14.4 per cent. of these children never used a tooth-brush, 58.2 per cent. used one occasionally, and only 27.4 per cent. used one daily.

Sufficient evidence has already been gathered to indicate that the school is a factor in the spread of communicable diseases in rural communities, due largely to the fact that the children of different families are rarely in intimate contact except at school. The question then arises, How are all these conditions to be remedied? According to Clark, the answer is: By abolishing school districts and establishing a county unit of school administration; by establishing an efficient system of health supervision of school children; by consolidating rural schools. When it is borne in mind that rural school children in this

country constitute 60.7 per cent. of the total school enrolment of the country, the vast importance of caring for their health and of endeavoring so to bring them up that both mentally and physically they may be able to fulfil their duties and responsibilities is too obvious to require elaboration. In order to attain this object, their health supervision should be more strict by far than it is at present. This Indiana county, presumably, offers a fair example of what school children are in the agricultural districts, and the investigations of the Public Health Service plainly show that reforms should be promptly introduced if a decent standard of health among school children of the country is to be hoped for. Children of a school age spend more of their waking hours at school than at home, and it behooves the authorities to insist that every effort should be made to establish and maintain their physical and mental health.

The Value of the X-rays in Intrathoracic Disease in Children. The varying opinions expressed as to the value of the *x*-rays in chest conditions is referred to by Freeman.¹ He believes that disappointment in the use of this means of diagnosis has often resulted from expecting too much from it. Alone, it is generally of little value, but, like other evidence, in combination with clinical history and other signs, it may be conclusive. Auscultation, our most valuable means for determining the character of intrathoracic lesions, is of materially less value than auscultation in combination with percussion, and auscultation and percussion aided by a good *x*-ray plate may fix a diagnosis that might otherwise remain obscure.

The results of radiography vary with the part that is to be radiographed. A good *x*-ray of bones is most readily obtained and gives most important results. X-ray examinations of the abdomen in children are frequently disappointing, although occasionally they give important information. Radiographs of the chest, however, in children are a material aid in diagnosis. They are probably of most value in making the diagnosis of miliary tuberculosis. It is often helpful in determining a pneumonia, of which we get no physical signs, in making a differential diagnosis between empyema and pneumonia or in corroboration of a diagnosis of diaphragmatic hernia. In lesions of the heart, it often furnishes reliable information as to enlargement, in modification in the shape of the heart, in dilatation, or the presence of exudate, and will often differentiate for us plastic exudate from fluid.

As to its use in the diagnosis of *miliary tuberculosis*, there is probably more accord than regarding other conditions, for the physical signs of miliary tuberculosis in the lungs are those only of a slight bronchitis. We see repeatedly children with a temperature, sibilant and sonorous rales, sometimes subcrepitant, of the significance of which we can get

¹ Archives of Pediatrics, December, 1916.

no definite estimation without the *x*-rays. A von Pirquet test, if positive, will render the diagnosis of tuberculosis more probable, but still leaves us with the possibility of a simple bronchitis in a child with a tuberculous lymph node somewhere in the body. Having, however, obtained a characteristic picture by *x*-rays, we no longer need to speculate on the lesion present.

The diagnosis of *pneumonia* in children, although usually evident to an intelligent pediatrician, we have learned from the use of the *x*-rays, is occasionally impossible. Cases of well-defined pneumonia may give rise to no physical signs, and, even after the pneumonia has been localized by the *x*-rays, a subsequent physical examination will give negative results. Diagnosis of fluid in the chest may often be corroborated by the *x*-rays. The presence of air in the chest is also well shown in the *x*-ray; if there occurs a combination of air and pus, one gets a pus level which is very characteristic.

The question often arises whether a *murmur* over the *heart* is a so-called hemic or anemic murmur, or a murmur due to a damaged valve in the heart. Many children are prevented from taking the exercises they should have for their physical development and health by the presence of a cardiac murmur without other evidence of cardiac disease. In such cases an *x*-ray of the heart gives one an excellent basis for an opinion as to the origin of the murmur. In diseases of the heart in children, the *x*-rays give us a most valuable indication of the amount of damage to the heart by the size and shape of the heart shadow, and successive pictures provide us with one of our best means for the control of exercise in these cases. For such control, the temperature and pulse-rate are of great value, but the *x*-ray picture will occasionally change our method of treatment to the advantage of the patient.

Another condition shown well by the *x*-rays, of which we get little evidence otherwise, is *enlargement of the thymus gland*, which gives a broad shadow above the heart. Enlargement of the bronchial and mediastinal lymph nodes may also be brought out by *x*-rays. In one other condition the *x*-rays are useful, and that is in corroboration of a diagnosis of *diaphragmatic hernia*.

The *x*-rays furnish a most important means of reaching a definite diagnosis of intrathoracic lesions. It should not be neglected in any obscure case. It is peculiarly adapted to children, as one can usually get a better picture of a child than of an adult, and because children, even when sick, can easily be carried to an *x*-ray laboratory.

The Prevention of Respiratory Disease in Early Life. Respiratory troubles are common at all ages, but notably so during the first five years of life. The deaths from respiratory diseases in this period constitute almost 40 per cent. of the total deaths from these causes, and 25 per cent. of the total number of deaths from respiratory diseases occur during the first year of life. This has scarcely changed since 1900.

Still gives figures from King's College Hospital, showing that of primary bronchitis occurring in children up to ten years, 52 per cent. occurred under two years and 34 per cent. under one year; 84 per cent. of cases of bronchopneumonia occurred in the first two years of life. In two other children's hospitals, 50 per cent. and 30 per cent. of lobar pneumonia cases occurred in children under two years.

After consideration of these facts and the great decrease of deaths from diarrheal diseases, R. S. Haynes¹ considers the special liability of infants and children under two years to respiratory disease. He believes it is affected during the latter part of the first year by the occurrence of rickets with its debility, its tendency to laryngeal spasm, and to thoracic deformity. Later, it is affected by the occurrence of measles and whooping-cough, and at all times by the common nasal obstruction due to the hypertrophied adenoid tissue. From birth, respiratory diseases begin to be in evidence. Hessthaysen has shown, in a series of 32 autopsies on children dying in the first three days of life, that 42 per cent. revealed pneumonia at autopsy. This was many times diagnosed as atelectasis. He concludes that the greatest casual factor in these cases of infection must be aspiration of the secretions of the birth canal during the second stage of labor. Holt and Babbitt, in their investigation of the deaths among 10,000 consecutive births at Sloane Maternity Hospital, called attention to the large number of deaths from pneumonia occurring in babies under two weeks of age, and 8.6 per cent. were due to atelectasis. Of these children, irrespective of their stay in the hospital, no stay being longer, however, than thirty-two days, Holt and Babbitt report that 17 per cent., more than twice the mortality due to obstetrical accidents, died of pneumonia, the infection being acquired presumably after birth.

A number of anatomical factors inherent to infancy and early childhood make these respiratory affections more frequent and more serious. The narrowness of the respiratory passages tends to interfere with the inspiration of air, or even prevent it with the slightest swelling. This is true particularly with the nasal cavities, which are comparatively small. Here secretions may stagnate and bacteria proliferate with the greatest ease. The larynx, too, is relatively small, the glottis narrow, and the cartilages exceedingly soft and collapsible. Tumefaction is characteristically accompanied by spasmodic contraction. The walls of the bronchi are soft and susceptible to dilatation. Their caliber is small. Consideration of all these factors leads us back to the realization that in prevention of respiratory diseases, as in other infectious processes, there are two principal factors: (1) The destruction or exclusion of the infecting organism; (2) the preservation of the resistance of the individual, of which the second is now recognized as being by far the most important.

¹ Archives of Pediatrics, February, 1916.

We see, in connection with the first condition, that transference by contact is the method in most cases and that it may be avoided by real cleanliness. In connection with the second, the preservation of a perfectly functioning vasomotor system is of the greatest importance in the protection of the individual against the physical enemies of his environment. The accumulation of the products of fatigue and intoxication must be prevented if the natural defenses of the body are to be adequate.

Bacteriology of the Urine in Healthy Children and those Suffering from Extra-urinary Infection. This subject is considered by Helmholtz,¹ of Chicago, who reviews the facts with regard to pyelocystitis in infancy and childhood. It has been established that the infection is very much more common in girls than boys, and the infecting organism is more frequently the *Bacillus coli*. The symptomatology is so indefinite as to make diagnosis practically dependent on the examination of the urine. Regarding the mode of infection, there is considerable difference of opinion. The main facts in favor of the urethral route are the predominance of cases in girls, the shortness of the urethra, and the fact that the orifice of the urethra is constantly contaminated with colon bacilli. The question as to the mode of infection is, however, far from being settled. In order to get an idea of the field involved, it seemed essential first of all to determine the bacteriology of the normal urine and urethra, and with this object the bacteriological findings of catheterized specimens of urine taken from thirty infants and from thirty-one girls over two years of age are recorded. The catheterized specimens were obtained by a careful technic and collected in three sterile tubes, so as to determine the difference between the first urine passed and the last. In the course of a few experiments, tubes 1 and 2 were found to be practically identical, so that in the majority of instances only tubes 1 and 3 were used. The tabulated results showed that, of 12 normal cases, 5 had sterile urine. Of specimens that were not sterile, 3 showed one organism per cubic centimeter, and 2 three organisms per cubic centimeter; 2 had organisms in the first portion of the urine but none in the last.

In summarizing the results of these examinations, it was found that in 119 specimens of carefully catheterized urine from 61 different individuals, 61 were sterile and 58 contained bacteria. Of those from normal infants, 13 were sterile and 11 contained bacteria. Of 13 extra-urinary infections under two years of age, 10 were sterile and 3 contained organisms. In the specimens from girls over two years of age, 35 were sterile and 27 contained organisms. The number of bacteria found in the first series was considerably larger than in the second series. This might be explained by the fact that in the older children

¹ Archives of Pediatrics, May, 1916.

one could cleanse the urethral orifice much easier than in the infant and introduce the catheter directly into the urethra. The bacterial flora was practically the same in both series, Gram-positive staphylococci and pseudodiphtheria organisms predominating; the former were present in practically every case in which any bacteria were found. In no instance were Gram-positive organisms found in any such numbers in both specimens that it seemed probable that it was anything more than a contamination from the urethra. In conclusion, it might be assumed on the evidence given, that organisms of the colon group were not normal inhabitants of the female urethra, and that in the extra-urinary infections occurring in the first two years of life the colon bacilli were frequently found in the urethra, that is, in about one-third of the cases. In girls over two years of age, the urine was almost free from organisms and entirely free from bacilli of the colon group.

BACTERIOLOGY OF THE URINARY TRACT IN CHILDREN. The symptomatology of *pyelocystitis* in the young is so indefinite as to make the diagnosis depend essentially on the bacteriological examination of the urine. While it is generally recognized that the most common infecting organism is the colon bacillus, the question of the mode of entrance into the urinary tract has not yet been answered to the satisfaction of all.¹ It is understood that infection may occur by way of the blood stream and perhaps also by way of the anastomosing lymphatics of the large intestine and urinary tract. An ascending infection along the route of the urethra seems to be the most probable, or, at any rate, the most common, source of the disease; and this conclusion is fortified by the fact that in correspondence with the more ready contamination of the urethral orifice, pyelocystitis is much more common in girls than in boys. Investigators at the Children's Memorial Hospital, Chicago, working in the S. A. Sprague Memorial Institute laboratory, have wisely decided that the first essential for a definite conclusion on the subject at hand rests in a study of the bacteriology of the normal urine and urethra of children.

Surprisingly little has heretofore been ascertained about the relation of bacteria to the urinary tract in young persons. Beeler and Helmholz, who carefully examined 12 healthy children under two years of age, conclude that organisms of the colon bacillus group are not normal inhabitants of the female urethra. On the other hand, in extra-urinary infections occurring in the first two years of life, the colon group of bacilli is frequently found in the urethra (one-third of the cases). Furthermore, in girls over two years of age, among whom greater care can be exercised in catheterization for diagnostic purposes, the urine is almost free of organisms, and it was always found entirely free from bacilli of the colon group by the Chicago investigators. The bacterial

¹ Journal of American Medical Association, November 18, 1916.

flora was practically the same in all the specimens examined, Gram-positive cocci and diphtheroid organisms predominating, the former being present in practically every case in which any organisms were present. In no instance were Gram-negative bacilli found in such numbers that it seemed probable that their presence resulted from anything more than an accidental contamination from the urethra.

Pyelitis in Infancy. An extended study upon the mode of infection in infants is reported by R. M. Smith,¹ of Boston. He said there were two antagonistic theories to explain the mode of infection of the kidney in pyelitis of infancy. One maintained that one takes place through the urethra, bladder, and ureters; the other that the infection came by means of the blood and lymphatics. The disease is much more common in the female than in the male, the proportion being nearly three to one. The disease is most frequently caused by the colon bacillus. Directly against the ascending theory of infection are the facts that the colon bacillus has never been shown to pass up the normal unobstructed ureter, and that the colon and tubercle bacilli have been introduced repeatedly into the bladder and in the presence of a normal mucous membrane, and were excreted without creating damage of any kind. Ascending infections occur only in the presence of obstruction to the outflow of urine, and do not occur if the sphincter of the ureter is normal. The theory of infection of the kidney by the blood and lymphatics rests upon surer ground. Dr. Smith has made 71 cultures from the vagina, vulva, and urethra of forty infants and young children. One infant, six hours old, and all over eighteen hours, with the exception of an infant six days old, showed growth from the vaginal culture. All the vulvar and urethral cultures were positive. The first organisms to appear were streptococci and staphylococci, and then the small bacilli, not colon. Colon bacilli were found in vaginal cultures of infants as early as the fifth day. He said that his findings were in accord with those of Schmidgall, who found the vagina of the newborn sterile 10 out of 13 times and by the second day a profuse growth of cocci. The colon bacillus was isolated 12 times out of 21 in newborn infants after the second day.

It was shown also that the vaginal secretions did not kill off the pathogenic organisms. A possible source of infection with colon bacilli or other bacteria is certainly present in the female vulva, urethra, and vagina, and a slight trauma might easily accomplish the entrance of organisms into the lymphatic vessels and blood, and thus to the kidney. The source of infection in pyelitis, in the majority of instances, males and females together, is the gastro-intestinal tract. Some cases might arise from infection in the skin, teeth, or tonsils, or in some local septic process. Many cases in females, accounting for the greater number in this sex as compared with the males, may arise from bacteria entering the blood often *via* the lymphatics from the vulva, urethra, or vagina.

¹ Archives of Pediatrics, May, 1917.

Vaginitis in Childhood. An extensive investigation upon this subject was instituted by the American Pediatric Society.¹ It was carried out by means of carefully prepared questionnaires, designed to consider the subject from different stand-points. Seven series of questions were sent, divided as follows: (1) Health officers, cities and States; (2) physicians; (3) pathologists and bacteriologists; (4) hospitals; (5) children's homes, training schools, and asylums; (6) gynecologists; (7) social service departments in hospitals and visiting nurse societies.

As a result of the evidence obtained, it was decided, after prolonged discussion, that the society should address a letter to health officers of States and cities, containing the following recommendations: That cities should be required to provide adequate hospital and dispensary facilities for the care and treatment of children having vaginitis. That matrons be placed in charge of girls' toilet rooms in public schools. That toilet seats embodying the principle of the U-shape be used in all schools, and that the toilets be placed at the proper height for different ages. That city and State laboratories be empowered and equipped to make bacteriological examinations for physicians when patients cannot afford to pay a laboratory fee. That educational literature on the subject of vaginitis be prepared and distributed to mothers through the medium of physicians, hospitals, health centers, visiting and municipal nurses. That asylums for children and day nurseries be licensed, and that the license be not granted unless: (1) the institution has ample facilities for recognition of gonococcus vaginitis, and, (2) that the institution exclude children having this disease if they cannot be properly isolated.

It was further decided that the American Pediatric Society should address a special letter to hospitals which care for children, containing the following recommendations: That separate wards be maintained for the treatment of children with vaginitis who are also suffering from other diseases. That microscopic examination of smears be made before admission to the general wards of the hospital. In securing material for the smears, care should be taken to observe rigid aseptic precautions. That observation wards be provided. That individual syringes, bedpans, catheters, clinical thermometers, thermometer lubricant, wash basins, soap powder, wash cloths, and towels be provided. That single service diapers be used (at least for girls) or that diapers be sterilized in an autoclave at fifteen pounds' pressure for five minutes. That nurses be required to make daily inspection of the vulva of each at the time of bathing, and to report immediately the presence of the slightest suggestion of a vaginal discharge. That low toilets be provided and equipped with seats embodying the U-shape principle. That, for routine purposes, the spray be used in place of tub baths for the bathing of

¹ Archives of Pediatrics, May, 1916.

young girls, and that older girls be sponged in bed. That nurses receive special instruction as to the nature of vaginitis, the ease with which it is transmitted, the methods of preventing its spread, and the necessity for rigid aseptic surgical technic in its handling and treatment. That a dispensary with special facilities for the treatment of gonococcus vaginitis be provided. That nursing care and supervision be given in the home. That mothers be instructed as to the dangers of vaginitis, the manner in which it is transmitted, the best method of protecting other children, and the necessity of prolonged observation. That all cases of vaginitis under observation be voluntarily reported to the local health officer in States or cities where no legal requirements are in force.

Rachford,¹ of Cincinnati, in discussing the subject, said that in the hospital with which he was connected they had a ward divided into four compartments for the treatment of this form of infection. The patients were admitted to the first compartment and passed through the other compartments as they progressed. When they were discharged from the fourth compartment they were turned over into the hands of the children's clinic, where they were kept under continuous observation. He believed that there were many things that would have to be taken into consideration before vulvovaginitis could be made a reportable disease. The first would be to change the attitude of the public. At the present time the very mention of vulvovaginitis struck terror to the people and it carried with it a stigma of disgrace. This attitude should be changed, and the public made to understand that vulvovaginitis in children was a different disease from gonococcus vaginitis in the adult. He thought nothing could be accomplished by reporting these cases so long as the term *gonorrheal* was used.

Acidosis as it Occurs in Childhood. Some of the best work on this subject in recent years is that of Howland and Marriott,² of Johns Hopkins University, who say that the term acidosis is at present very loosely employed in clinical medicine, being used for the most part to indicate that acetone bodies had been found in the urine by qualitative tests. It is assumed that acetone bodies are very abnormal and that their presence signifies an unusual complication in the course of disease; whereas, in many instances, we may liken the mere presence of acetonuria to fever, in that it occurs in most of the infectious diseases of childhood with much the same regularity that fever occurs. Hyperexia may, however, develop and in itself be dangerous or fatal; so, too, a production of acetone bodies may, in itself, determine a fatal outcome. But the quantitative difference between the mere presence of acetone bodies and their production in amounts to threaten life is an enormous one. Acids are always being formed in the body and measures are always

¹ Archives of Pediatrics, May, 1916.

² Ibid., February, 1916.

being taken to neutralize and get rid of them. Moreover, it is not the mere presence of acetone bodies that determines acidosis. In order to understand how acidosis may be brought about, or, in other words, how the normal relationship of alkalies to acids in the body may be disturbed, it is necessary to consider the method by which the body maintains the equilibrium, in which there is a preponderance of bases over acids. With extraordinary regularity, the blood is maintained at a constant reaction, which is highly alkaline. The body is constantly elaborating acids as the result of oxidative processes in intermediary metabolism. In addition, certain organic salts are formed in small amounts and usually transformed completely into carbon dioxide and water, though a small quantity of such substances, as lactic and uric acids, leave the body unchanged. Also acid radicals predominate in the mineral constituents of many of the common foods.

To guard against the deleterious influence of acids formed or introduced into the body, a most efficient mechanism is available. It is only necessary to consider the mechanism from the stand-point of the blood, for this serves to regulate the reaction for the entire body. The important constituents of the blood influencing this regulation of the reaction are sodium bicarbonate, occurring chiefly in the plasma; the acid and alkaline phosphates of potassium, found almost entirely within the red blood cells, and the proteins. Acids, whether formed in the body or introduced from without, displace the carbonic acid from the sodium bicarbonate and set carbon dioxide free. This excess of carbon dioxide is removed by the increased pulmonary ventilation, leaving a neutral salt sodium oxybutyrate, or chlorine, or what not, to be removed by the kidneys. Such a mechanism allows relatively huge amounts of abnormal acids to be at once rendered innocuous and removed. Thus, dyspnea or, more properly, hyperpnea, under abnormal circumstances, is an agent of the greatest value in ridding the body of carbon dioxide and keeping the reaction within normal limits. Hyperpnea is the best of all the evidences of acidosis to be obtained by physical examination alone. If the bicarbonates of the plasma were the only method of defence, the organism would succumb to acidosis as soon as the carbon dioxide was depleted by the excretion of neutral salts through the kidneys.

The second mechanism here comes into play by which the acids may be removed, leaving behind parts of the base with which they have been combined, this base being available for further neutralization. The elimination is by way of the kidneys. These have the capacity to excrete an acid urine from a nearly neutral blood. They remove acid phosphate and save the base with each molecule of acid phosphate they excrete. The small amount of alkali thus lost can readily be replaced under normal circumstances by the alkali of the food. A third method of defence is afforded by the proteins. It depends upon their

amphoteric character. These three means of defence act synchronously and reside in the blood itself.

The body possesses a further means of defence in that it is able to neutralize acid by the production of alkali in the form of ammonia. When acids are introduced or formed in the body in an unusual amount, a response occurs in an increased production of ammonia. This is formed at the expense of urea, and hence represents a clear gain of alkali. From a consideration of these facts, it is plain that there may be all degrees of acid production and retention, as a result of which it is difficult to set a limit and say that acidosis is present. The mere presence of abnormal acids does not indicate that there is acidosis, for they may be entirely compensated for by the various means that have been referred to. In excessive amount, however, they may be productive of great harm. Furthermore, severe and fatal acidosis may occur when no abnormal acids can be found. The means by which acidosis is recognized are: (1) Examination of the urine or the blood for the presence of abnormal acids, and (2) by seeking for evidence of unusual activity of the body's defences by determining the amount of ammonia excreted in the urine and its relation to the total nitrogen excretion. A high ammonia coefficient always arouses the suspicion of acidosis, but, unless this can be confirmed in some other way, it should not be taken as conclusive proof, for fatal acidosis may occur in uremia and in nutritional disorders of infants with no considerable increase in the ammonia coefficient.

We determine the evidences of increased pulmonary ventilation by spirometer measurements or by the determination of carbon dioxide percentages in the alveolar air. There is a diminished carbon dioxide tension of the blood in acidosis because there is less bicarbonate in the blood. Some of it has been taken to neutralize acids, and what is left is incapable of maintaining the normal reaction of the plasma when carbon dioxide of the tissues is poured into it in unusual amounts. There is a shifting of the reaction of the blood toward the acid side, and thus the respiratory and pulmonary centers are stimulated, and the increased pulmonary ventilation serves to rapidly remove the carbon dioxide, and the carbon dioxide level in the blood is lowered. The blood reaction tends to return to normal, but as the carbon dioxide is constantly formed, the dyspnea becomes constant unless the sodium bicarbonate content of the blood plasma is renewed. The quantity of carbon dioxide excreted by the lungs is not appreciably changed, but it is diluted as the result of the increased amount of air entering and leaving the lungs. For this reason the carbon dioxide percentage or tension of the alveolar air is lower than normal. Bicarbonate deficiency in the plasma is an indication of acidosis.

In childhood, acidosis resulting from the production of abnormal acids is found chiefly in diabetes and recurrent vomiting. A study of

diabetes in children shows very well the enormous amount of acid that may be taken care of with no disturbance of the reaction of the blood and with no effect upon the respiration.

In recurrent vomiting, the conditions are more obscure and less understood than in diabetes. Alonzo Taylor, in the study of one typical case, has found that the presence of acetone bodies might be referred to starvation, since in this case they did not appear until two or three days after the onset of the attack. Hilliger observed the production of recurrent attacks of recurrent vomiting by limiting the carbohydrate intake, but we can hardly look upon the carbohydrate restriction as the usual cause of attacks of recurrent vomiting. Neither are the acetone bodies usually slow in appearing in the urine; they are often found in large quantities in a few hours after the beginning of the vomiting, and cannot be accounted for on the basis of starvation. The writers have studied chiefly the acidosis occurring in the diarrheal diseases of infancy, and have found that infants with severe diarrhea may die with no evidence of acidosis whatever. This was true of the majority. On the other hand, a number of infants with diarrhea do develop evidence of acidosis and the overwhelming majority of these die. The clinical evidence of acidosis is hyperpnea.

It might be possible to stop the clinical and laboratory evidences of acidosis in infants, but they usually die. For this reason we should not wait until acidosis can be demonstrated. From the beginning we should give sodium bicarbonate to infants suffering with diarrhea in sufficient quantities to render the urine alkaline and keep it so. The alkalies might be given by mouth, by rectum, subcutaneously, or intravenously. Intravenous administration is the method of choice when rapidity of action is desired, as in acidosis. If facilities for intravenous injection are not at hand, the injection may be made subcutaneously. A 4 per cent. solution was employed by the authors for the intravenous, and a 2 per cent. solution for the subcutaneous, injections. As much as 10 grams in twenty-four hours may be required.

Dr. Donald D. Van Slyke¹ said that the experience just narrated was in entire accord with that of Dr. Howland. It had been suggested, however, that some interest would attach to a definition of acidosis from a chemist's point of view. Such a definition would be: "Acidosis is a condition in which an accumulation of acid occurs in the body and which results from the failure of elimination to keep pace with the production of acids." It may result, as in diabetes, from an overwhelmingly rapid production of acids, which even a normal eliminating mechanism cannot keep up with; or it may, as in some cases of nephritis, result from failure of the eliminating mechanism to dispose of even the amount of acid formed in ordinary metabolism. Whatever the cause,

¹ Archives of Pediatrics, February, 1916.

the direct result is that the bicarbonate content of the body fluids is lowered, since the retention of any of the metabolic acids other than carbonic results in decomposition of an equivalent amount of bicarbonate in the fluids. Because of this fact the determination of the bicarbonate content of the blood plasma is the most direct method for detecting the presence and severity of acidosis. So far as his experience goes, the severity of acidosis is proportional to the fall of the bicarbonate content of the blood below the normal.

In their last contribution upon this subject, Howland and Marriott¹ say that acidosis and acetonuria are not synonymous terms. There is no justification for believing that acidosis due to the acetone bodies occurs in epidemic form. Deficient blood or increased requirement for food (disproportion between caloric intake and output) is the chief cause of acetonuria, but this rarely results in acidosis. The production of acetone bodies occurs at times when starvation cannot be held responsible. The production is rapid and excessive, and sufficient to cause serious or fatal acidosis. This condition is not necessarily caused by vomiting. It probably depends upon the same underlying disturbance as do the majority of cases of recurrent vomiting.

Early Morning Vomiting in Children. Attention is directed by Southworth,² of New York, to the vomiting of children which not infrequently occurs in the early morning either soon after, or before, the first feeding. This he believes to be of toxic origin, since the vomitus after the long night period contains no food residue unless a morning feeding has been given. It is sharply distinguished from the vomiting of undigested and fermenting food from failure of gastric digestion, which usually occurs later in the day. The cases, one of which was related as typical, had neither the characteristic histories nor the clinical symptoms and course of recurrent vomiting which is another toxic type. He believes that in the recurrent type the toxemia is probably of gradual and cumulative evolution, brought to a head by constipation or some unusual factor. Elimination is slow, and vomiting prolonged. Fever is not constant. In the type under consideration with early morning vomiting, fever is a usual accompaniment, often rising sharply, and there is an acute putrefactive process in the intestine, with absorption and attempted reëlimination by the gastric mucous membrane. He assumes that this toxic material accumulates in the stomach during the hours of slumber, when reflexes are more or less deadened, and asserts its presence in vomiting after awakening. Purgation results in foul stools, often containing mucus. After the stomach is emptied by one or two acts of emesis at short intervals, there is not the same tendency to recur which pertains to the recurrent type. He believes that the extreme caution in the resumption of feeding, often displayed after attacks of recurrent

¹ Journal of American Medical Association, November 4, 1916.

² New York Medical Journal, September 2, 1916.

vomiting, frequently lead to undernutrition in children whose attacks occur at rather short intervals.

Southworth said that he had not made any tests, but thought it probable that some of the children might have had hyperchlorhydria. A great many children with gastro-intestinal disturbances have an odor of acetone in the breath. He had made no examination of urine in these cases. He felt sure that the gastro-intestinal condition was the cause of the symptoms, as these all subsided when the gastro-intestinal tract was cleared out. There had been no cough or nasopharyngeal mucus.

Status Lymphaticus. After discussing this condition in its relation to operative measures for other diseases, Culbert,¹ of New York, wisely concludes that a thorough physical examination of all children who present themselves for operation, especially those for removal of adenoids and tonsils, is most necessary. More particularly when they show any deviation from the normal should we look all over the body for enlarged glands, bone deformities characteristic of rachitis, and areas of sternal dullness. Pribram, of Prag, draws special attention to enlarged papillæ at the base of the tongue and an omega-shaped epiglottis. If any stigmata are present to make us suspect an enlarged thymus, operation should be refused, or at least deferred until a full laboratory investigation can be made, including, of course, skiagraphs.

Macewen's Sign. *Percussion of the skull* to distinguish the note produced by intracranial lesions offers at times valuable information as to the existence of disease in the brain and its coverings. That an increase of the spinal fluid produces a marked effect upon the percussion note of the skull is a fact which has been noted by various writers during the past thirty-three years. The subject has been considered in detail by Wilcox.²

Macewen first referred to percussion of the skull in connection with the symptoms and diagnosis of *brain abscess*. He considered the note to be caused by vibrations occurring in the cranial walls and to be influenced by the condition of the cranial contents and their relation to the parietes. Frozen sections made through the heads of hydrocephalic children show the meninges to be closely crowded against the bony walls. He stated that a thin skull vibrates more quickly than a thick one, but that a skull may be so thin or so thick that it cannot vibrate at all and that, in the cranium of an infant, the note is so dull, slight, and flat as to be scarcely perceptible. If, however, increased intracranial tension subjects the parietes to pressure, the note becomes clear.

The diagnostic value of the sign has been questioned by some, perhaps, because as yet there has been no definite attempt to classify skull

¹ New York Medical Journal, October 14, 1916.

² Archives of Pediatrics, December, 1915.

percussion with reference to size, density of skull, stage of development of the bones, and influence of disease upon these bones. In order to conclude anything from such percussion, there must first be established a normal note for the various sorts of skulls that come under observation, as is recognized in the percussion of the chest. It is such an analysis of the notes produced by percussion of the skulls of children from birth to twelve years of age, children who are normal as to their osseous development, or those who have suffered in this respect through rickets or other diseases resulting in malnutrition. That is the basis of this paper. The observations were made in the service of LaFétra at Bellevue Hospital in the years 1911 to 1914.

Percussion of a hydrocephalic skull or of a skull with wider-open fontanelles, with open sutures, or marked craniotabes, will differ from that of the thickened skull attendant upon retarded cerebral development. What is true of the cranium itself is true of its contents, for as changes in the development of any viscus under investigation influence the note produced by percussion, so pathological changes affecting the density of tension of the skull contents will influence its percussion. A rachitic skull at six years will give a percussion note similar to that given normally in an infant of six months. If this case develops an increase of spinal fluid, a sharp, high-pitched, clear note is at once found to have replaced the former low-pitched, dull, non-resonant percussion.

In congenital hydrocephalus, or that occurring so early in infancy that the cranial walls must consist of thin fibrous plates with large fontanelles, and sutures completely open, no note is obtained on percussion. Even when the tension is great, there is no structure present suitable to the production of vibrations. If the disease has developed later in a normally ossified skull, the note will be most typically "cracked-pot" when the sutures are loose, but not widely separated. If the latter are widely separated, the note will be high-pitched, sharp, and ringing, but will have less of the "cracked-pot" quality.

Macewen's sign is best determined by the stethoscope placed on the forehead just above the base of the nose. The skull is tapped directly with the percussing finger or hammer over the parietal region, beginning just over the parietal boss, from which the percussing finger should approach the point at which the stethoscope is applied. This should be carried out on both sides of the head. The typical sign, observed in this way consists in a high-pitched, sharp, short, cracked-pot note. It is most distinct when percussion is being done over, behind, or below the parietal boss on either side, is unchanged as the point percussed, passes downward, and diminishes in intensity and character as the percussing finger approaches the stethoscope.

The author concludes that skulls of children of various ages and development have percussion notes peculiar to the state of the cranium. It is possible to establish a note normal to the various types of crania

found in infants and children. A positive Macewen sign exists when a variation from the normal note is found. It consists in a relative change rather than a definite condition common to all diseased crania. The sign is better elicited by the stethoscope than by the unaided ear. Increased clearness of sound when percussion is done over the posterior portion of the skull rather than near the stethoscope is diagnostic. The sign uniformly accompanies conditions of increased cranial tension and is not found unless this causative factor exists. It is equally applicable to infants and older children. It was present in 50 of 53 cases of tuberculous meningitis, and in 17 of 18 cases of meningitis of other types. It was present in all of 5 cases of poliomyelitis. It was found to vary directly with the development and recession of cerebral symptoms as complications of disease not directly affecting the central nervous system. It was present in 11 of 13 cases of pneumonia, in 5 of which lumbar puncture showed increased cerebrospinal fluid under pressure. The sign is uniformly lacking in children normal as to the brain and its coverings.

Chorea. An elaborate study upon the *etiology* of chorea is reported by Morse and Floyd,¹ of Boston. It was undertaken primarily to determine the part which syphilis and bacterial infection play in the etiology of the disease. They conclude that syphilis plays no part in the production of chorea. No microörganisms were found in the spinal fluid, but various bacteria were found in the blood. None, except a streptococcus, would produce lesions in animals. This organism did produce chorea in rabbits. The organisms found in different cases were different. There was a local infection in all cases in which cocci were found in the blood, so these organisms might have nothing to do with the chorea. They did not, therefore, consider the bacterial origin of chorea proved. They believe, nevertheless, that chorea is intimately connected with rheumatism and endocarditis.

In discussing this paper, Koplik² said he agreed with Morse's conclusions with reference to syphilis and chorea. He had made a number of blood examinations in cases of chorea, and in all cases had obtained negative results, and therefore felt that he could endorse Morse's conclusions. The streptococcus might possibly have been the cause of the endocarditis. He had had a number of cases of chorea in which endocarditis had come on secondarily. It seems that our methods of blood culture must still be improved, and then again it might be that the bacteria disappeared at a certain period and left a toxin.

Abt,³ of Chicago, said he had gone over his hospital records and had very infrequently obtained a history of rheumatism, infection, or any febrile condition; it is certainly not true that all those said to have

¹ New York Medical Journal, September 2, 1916

² Archives of Pediatrics, May, 1916.

³ Ibid.

chorea have an infectious chorea; they may have a nervous condition not connected with infection.

La Fétra,¹ of New York, said that at Bellevue Hospital several cultures were made from the blood of choreic patients and the *Streptococcus viridans* was recovered. The technic employed could not be very exact, for in the same laboratory with the same blood some obtained microorganisms and some did not.

Observations made upon 226 cases of chorea are reported by Abt and Levinson,² of Chicago, who found that the frequency of chorea was about 22 per cent. of all the children treated at their hospital. The age incidence ranged from three and a half to eighteen years. The ages of most frequent occurrence was between five and fourteen years. The ratio of females to males was 2 to 1. Season did not play a constant role. The greatest number were observed in January and December, the smallest in October. In these patients the relation between rheumatism and chorea was not marked; 13 had a definite history of rheumatism; 130 had no history of rheumatism. They believe in the relationship between rheumatism and chorea, although their cases do not bear it out. Tonsillitis was not a prominent factor. Sixty-six per cent. had no history of tonsillitis. In their series infectious diseases were frequently found to precede the onset of chorea, but there seemed to be no close relationship between infectious diseases and chorea. Syphilitic manifestations were present in two cases. They seemed, however, to have no connection with the chorea. Localization was frequent. Endocarditis was frequent, though not a constant, complication. The mortality was a little less than 1 per cent. The duration of the disease varied from one day to more than a year. The average duration was from two to eight weeks. Recurrences occurred 35 times. One patient had 4 recurrences; four had 3; and twenty had 2. The method of treatment had no direct bearing on recurrences. For treatment these observers are strongly in favor of rest in bed and complete isolation, baths, and salicylates. They do not believe that arsenic had any special effect on the disease. If it be given in too large doses, it may be pernicious.

The *hospital treatment of chorea* is discussed in a carefully written article by Pierce Bailey,³ of New York. It consists principally of rest and isolation. This means rest in bed with curtains drawn, and no communication allowed with other patients in the ward, and no visitors. In certain cases cold packs are given, and, in the presence of rheumatic history, and even without it, rheumatic remedies, especially aspirin, are prescribed. In a few violent cases, lumbar puncture has been used. When the cerebrospinal fluid has been under pressure, it seems to dim-

¹ Archives of Pediatrics, May, 1916.

² Journal of American Medical Association, November 4, 1916.

³ New York Medical Journal, September 3, 1916.

inish the movements very promptly. Several weeks of complete rest are necessary to overcome the irritability of the nervous system, so that, even if, after a lumbar puncture, all symptoms disappear, it seems wiser, wherever possible, to insist on a three or four weeks' treatment for the purpose of reëstablishing the tone of the nervous system.

Most of the patients, who stay less than ten days, leave for some reason other than that directly connected with the disease. In a few cases in whom choreic manifestations disappear in two or three days, the parents have taken the child home. Bailey does not feel, however, that ten days is sufficient treatment for even a mild case of chorea. The period between ten and thirty days is the time in which most of the cases fall. At the end of this period, in the majority of cases, no twitchings having been noticeable for some time, and the patient, so far as can be seen, is well except for cardiac murmurs or lesions which may still persist. A few patients who have stayed longer than thirty days have been cases of very long-standing, or else are those in which the chorea seemed another manifestation of a deeply imbedded, long-standing rheumatic tendency. Sleep, after the first few days, is generally very good, although some restlessness and talking may persist for a longer period. Relapses recur, but they are comparatively infrequent after hospital treatment. Only three patients have been treated in the hospital on repeated admissions.

Bailey considers the results encouraging because so many patients have come with histories of previous attacks; several patients have had three or four. His general conclusions are that by rest and seclusion, when treatment is extended over a reasonable period, chorea can be permanently cured without much danger of a relapse, and, in view of the general relapsing tendency of the disease, he feels that the treatment of chorea is one of the most important functions of a neurological hospital.

A highly interesting and, perhaps, a highly important paper is a preliminary report upon the *autoserum treatment of chorea* by Goodman,¹ of New York. The method, briefly stated, is as follows: After having excluded tuberculosis and syphilis, the child lies in bed for three days or longer without any medication. Then 45 to 50 c.c. of blood are withdrawn from a vein and rapidly centrifuged. The serum is then pipetted off and kept on ice. A lumbar puncture is performed in the usual manner. The fluid is very slowly withdrawn until about 20 c.c. is collected. The serum is then heated to body temperature, and very slowly injected into the spinal canal. Such an injection should take from ten to fifteen minutes, and usually from 15 to 18 c.c. of serum is used. The patient should remain in a recumbent position for at least one hour after the injection.

After having made a number of investigations of the blood and spinal

¹ Archives of Pediatrics, September, 1916.

fluid, both chemically and bacteriologically, to convince him of the harmlessness of injecting the serum of these patients into the spinal canal, he made the first injection in April, 1913. Following this first injection, the patient went into a deep coma, which lasted for thirty-six hours. Upon regaining a normal mentality, the choreiform movements had entirely disappeared. In studying the cause of the coma, it occurred to him that it might be due to the fact that the child had been receiving chloral and codein to control the violent chorea movements, and in treating subsequent cases this proved to be correct. Before giving the injection he always permits the patient to be without medicine for at least four or five days. It seems there must be some chemical action in the blood plasma which causes a very potent action of the drugs when injected into the spinal canal.

After giving a number of these injections, Passini published a report of a number of cases in which he only withdrew the spinal fluid, and believed he saw benefit in three of the five cases reported. Goodman tried this method, but found it unsuccessful. He also tried the injection of serum from one case into other cases suffering from the same disease, but the results were not successful. It is absolutely necessary to use the serum of the same case in order to get the desired result. The result from the intraspinal injection can be demonstrated within the first two or three days. At times there is a slight reaction due to a rise in temperature, accompanied sometimes with a slight headache. This does not occur in every case. Sometimes there is vomiting. It may be due to the injection of too much serum, causing increased intracranial pressure. The quantity of serum to be injected in each case must be studied carefully.

With all the treatments hitherto published, the course of infectious chorea lasts from four to six weeks, or longer; with the autoserum treatment, the result is manifested within two or three days. Sometimes the patient needs a second injection and sometimes a third. Usually a single injection is enough. Two patients returned within a year with a relapse. These relapses are usually mild and amenable to treatment. Of the 30 cases treated, there have been no untoward results. It is amazing to see how quickly most cases respond to the treatment.

Of the 30 cases treated, 18 were female and 12 male. The youngest case injected was four years of age, the oldest twenty-eight. Of the 30, 18 were under ten years of age, 10 were from ten to fifteen years of age, 1 from fifteen to twenty years of age and 1 from twenty to thirty years of age. Fourteen received one injection, 8 received two, 5 received three, and 3 received four injections. Of those receiving 1 injection, 12 were cured and 2 markedly improved. Of those receiving 2 injections, 5 were cured and 3 markedly improved. Of those receiving 3 injections, 2 were cured, 1 markedly improved, and 1 unimproved. Of those receiving 4 injections, 1 was cured, 1 markedly improved, and 1 unim-

proved. *Cured* as used by the writer means absolute cessation of all twitching within a week; *markedly improved*, a cessation of all twitchings within two weeks; *slightly improved* when the twitching disappeared at the end of the third week; and *unimproved* when the twitchings were still present during the fourth week.

Chronic Digestive Disorders in Children. Chronic digestive disorders in children are usually looked upon as due to bacterial infection, perversions of function, or chronic appendicitis. That some of these conditions may at times be dependent upon mechanical agencies operating in the digestive tract has apparently received but little thought. An extended series of observations, with *x*-ray findings, is reported by Kerley and LeWald,¹ who conclude that intestinal disorders are found in many cases to be dependent upon hitherto unsuspected factors, such as abnormal size or length of the intestinal canal, or some part of it, as the sigmoid flexure. Reflex nervous conditions, convulsions, asthmatic attacks, food idiosyncrasies, etc., may be found to have their cause here, and may be cured by appropriate medical or surgical treatment based on the Röntgen-ray disclosures. The degree and cause of constipation may be determined in a definite manner hitherto impossible. Relaxation of the abdominal viscera may be detected in its incipiency and may be corrected before it has become the disabling condition which it is known to assume in the adult, the treatment of which is one of the most difficult problems presented to the physician or surgeon today.

There are cases of gastro-intestinal disorders in children due to mechanical agencies. Such disorders will only be satisfactorily managed when the cause is known. When the child's parents are shown the nature of its trouble by *x*-ray findings, they give much better coöperation and have much less criticism of slow improvement.

Probably many cases of ptosis of the stomach and intestine in adults are of a congenital nature or have their origin during childhood because of erroneous habits in eating. The child of five, six, or eight years eats a large meal three times a day, and with this drinks two or three glasses of milk, which he is urged to take. All of which means that two pounds of food, or more, are placed in the stomach (more weight than many can accommodate) and ptosis results. Those patients who showed ptosis of the stomach and transverse colon were fitted with an Aaron band, modified for children's use, with a transverse ridge or shelf so placed as to support the prolapsed part. The child was allowed but 2 ounces of milk or water with each meal. Immediately after eating he was made to rest on the right side for one hour to accelerate the emptying of the stomach, which was always retarded. Two and a half hours after the meal, he was given milk or water to drink. In this way the weight of the food in the stomach at one time was lessened. In cases with

¹ Journal of American Medical Association, November 25, 1916.

the sigmoid loop and intestinal stasis and constipation, massage and gymnastics were of great service. Liquid petrolatum and olive oil, as a rule, give better results than other laxatives; but in some instances it was necessary to give aromatic fluidextract of cascara three times daily in sufficient amounts to produce an evacuation. In these cases, as in hundreds of others of constipation, drugs in cathartic doses may be harmful. Much better results are obtained by small doses of a laxative frequently repeated. With massage and right food, the oil and cascara may be gradually eliminated. Massage and suitable feeding may have to be continued for a long time, probably until the child has grown sufficiently for the pelvis to accommodate itself to the redundant sigmoid.

Dietetic regulations for the constipation cases are as follows: White bread, toast, and crackers are omitted. Potatoes, rice, milk, and eggs are given sparingly. Milk is often replaced by malted milk. Green vegetables are given twice a day. Stewed or raw fruits are given the preference as desserts. Fresh meats and fish are allowed. Whole-wheat bread and oatmeal crackers are advised. Raw fruits are given with the stomach supposedly empty an hour to an hour and a half before meals. Strange as it may seem, this rarely interferes with the appetite. The giving of raw fruits with the stomach empty is one of the most valuable means of managing constipation.

The Röntgen rays in the above series of cases demonstrated the uselessness and possible danger of the daily enema, high or low. It dilates and enfeebles the parts not involved, gives only temporary relief, and lays up trouble for future years. In those cases with diarrhea or loose evacuations, all fruits, raw or stewed, and all vegetables should be omitted from the diet.

Infant Foods. The principle has long been established in this country that the chief artificial food for infants is cow's milk. It passes through three agencies: the producer, the dealer, and the consumer. If the first two have done their part, clean, safe milk will be delivered, thoroughly chilled to the consumer. The consumer's responsibility begins the moment the milk is delivered at his doorstep. The following excellent formula is given for the care of milk in the home: "Keep milk clean, cold, covered."

In handling milk around the home, do not pour it from one vessel to another until it is to be consumed. Do not let the bottle of milk remain out of the refrigerator for a moment longer than is necessary. Keep the milk covered, using paper caps or an inverted tumbler on bottle, or store it in clean, covered utensils. Any household utensil that is to be used for keeping milk should first be cleaned thoroughly and scalded. Before opening the bottle of milk, wash and wipe the neck and outside of the

¹ Farmer's Bulletin 413. Department of Agriculture.

cap with running water. The little depression on the top of the cap may collect dust or water, and any milk that leaks out may attract flies. Lift out the cap with a sharpened instrument or a piece of wire kept for the purpose, so that the outside of the cap, which may be contaminated, will not be pushed down into the milk. Each time the milk is to be poured from the bottle it is a wise precaution to wash the neck as described. It scarcely need to be said that the careful physician will instruct mothers in matters of this kind.

The *pasteurization of milk* is a method regarding which there is still considerable disagreement. On the one hand, it is argued that by pasteurization certain elements of milk essential to proper nutrition, the vitamins, are destroyed or impaired, and the value of milk thus treated as a food for infants is greatly depreciated. Infantile scurvy is said to be caused in many instances by pasteurized milk,¹ and if lack of vitamins is largely responsible for infantile scurvy, and if pasteurization destroys or impairs the vitamins in the milk, the argument is certainly forcible and to a certain extent convincing. If it is granted that pasteurized milk is not so nourishing as it should be, that is, is lacking in elements which appear to be necessary to good health, still the method possesses certain counterbalancing advantages. When it is not carefully and scientifically done, the method is worse than useless, for it engenders false confidence, and, instead of protecting against disease, it is likely to spread infection. When the method is carried out on sound scientific principles, however, according to the views of a large number of medical men who have investigated the matter clinically and otherwise, it does provide at least fairly adequate protection against infection. Recently it has been suspected that the virus of poliomyelitis is conveyed by the agency of food, and especially by milk. If the statement is substantiated there can be little doubt that boiling or pasteurizing milk will go far toward checking an epidemic of infantile paralysis. Undoubtedly, pasteurization of milk is a protective measure of value when properly carried out, and it is probable that some of the prejudice against the measure is due to its careless performance. It should not be forgotten that home pasteurization is a very different matter from commercial pasteurization on a large scale.

If there were no changes from exposure to heat, rendering milk safe for food would be comparatively easy. Unfortunately, a temperature that destroys bacteria will have a bad effect on the medium itself. In order to obtain the best results, it is necessary that the milk shall from the first be as free as possible from bacteria. If this milk is then pasteurized, the consumer will be protected. Cleanliness is the essential feature not only for the man and his utensils, but for the cow as well; care is thereby entailed, and that means additional expense. To keep

¹ New York Journal of Medicine, October 28, 1916.

down the cost of production has been the desire of the dairyman. In order to obtain the milk more economically, various mechanical agencies are employed; a common one is the milking machine. The manufacturers of these appliances give full directions how to keep them clean; but, as they consist mainly of rubber tubing, there are many difficulties with which to contend.

Ruediger¹ has recently made comparisons between the bacterial counts of milk drawn by hand and by machines thoroughly scalded. In one dairy the bacterial count when the milk was drawn by hand into a sterile bottle was 860; with the milking machine, as generally used, the count was 2,450,000. But when all parts of the machine and can were thoroughly scalded the count dropped to 2430. The author says that when we consider the fact that milk is drawn through rubber tubes about three feet long and which have several connecting joints, and that these were cleansed but once a week, we are not greatly surprised by the result. If there is to be control over the quality of milk the only way is by bacteriological counts.

Infant Feeding. Two interesting and important articles have appeared recently upon the *history of infant feeding*. The one by Griffith² recounts the changes that have taken place in ideas regarding feeding during the past twenty-five years. The other by Mixsell³ gives an extended history of infant feeding dating back to ancient times. These papers, though valuable, do not lend themselves to condensation.

The subject of *boiled milk* has been studied in an experimental way by Daniels and Steussy.⁴ Their conclusions are that milk heated to boiling temperature or thereabouts is an inadequate food. Rats fed on boiled milk grew to about half their normal size. Although they were able to keep these experimental animals for many months on boiled milk, in no case did reproduction occur, nor did any of the animals reach the normal weight for adult rats. Milk which is kept at the boiling temperature for forty-five minutes is no less efficient as a food than milk boiled for much shorter periods—ten minutes or one minute. The chemical changes which make boiled milk an inadequate food are brought about at the boiling temperature or thereabouts. The value of pasteurized milk as a food therefore will depend on the temperature to which it is heated in pasteurization. Heating to a higher temperature than boiling (114° C.) makes it even less valuable as a food.

Rats fed both raw and pasteurized milk to which small amounts of meat extract were added grew at the normal rate. The explanation of this lies, possibly, in the fact that the meat extract caused an increase in the digestive secretions, thus making the milk more available.

¹ Journal of Infectious Diseases, October, 1916.

² New York Medical Journal, August 26, 1916.

³ Archives of Pediatrics, April, 1916.

⁴ American Journal of Diseases of Children, January, 1916.

The use of boiled milk is the subject of a paper by Brennemann,¹ whose conclusions are very favorable to its use. In his practical experience he feels that we can safely give larger amounts of milk and more concentrated solutions when we use boiled milk than when we use raw milk. Possibly the simplicity of such ideas is the only thing that commends them as compared with other methods that lead to the same result; but simplicity is a much longed-for factor in infant feeding.

If pasteurization did not offer almost insurmountable technical difficulties in the very homes in which it is most needed, or if commercial pasteurization were reliable, then it might at least solve the bacteriological problem. The physiological problem remains unchanged, as pasteurized milk remains in this respect essentially the same as raw milk. Commercial pasteurization would still be open to the objection that such milk must be kept for twenty-four hours, subject to decomposition or other abnormal bacterial activity. The relative activity of antiscorbutic properties in pasteurized or in boiled milk remains to be measured. In our present state of knowledge, it can hardly offset the manifest advantages over pasteurization or boiling milk in the home.

There can be but one opinion that milk should be safeguarded by all the means advocated by our milk commissions. Certification cannot, however, be imposed without making the milk so expensive that it is beyond the reach of that vast majority who need it most. That ordinary milk boiled in the home is a safe food for infants in this very social stratum has been abundantly proved by the Infant Welfare Society of Chicago, where such home-boiled milk is used in the vast majority of cases with almost incredible results. Bacteriologically, certification alone does not even approximately put certified milk in the same class as boiled milk. It offers the advantages, that cannot yet be measured, of being bacteriologically active, as compared with boiled milk. Physiologically, it is still raw milk, and that is why many boil certified milk.

The use of *citrated whole milk* has been discussed considerably in England, but has received but little attention in this country during the past year. Pritchard² believes that the secret of success of the whole milk method is the limited quantity of water used. He believes that while infants refuse to conform to a single standard, every effort should be made to meet special requirements by special methods. He holds, therefore, that the citrated milk method is unsound because it admits of no latitude for such adaptation or for the influence of varying conditions.

The subject is also considered by Carter,³ who holds that although good results are obtained from undiluted citrated milk feeding, the weight curve in cases thus fed typically rising more rapidly than under the

¹ Journal of American Medical Association, November 11, 1916.

² Practitioner, February, 1916.

³ Ibid.

dilute method, nevertheless his best results were gained by abandoning all routine methods and concentrating on the individual requirements of each case. The best results were obtained from whole milk feeding in cases of wasting associated with gastric dilatation, vomiting, and diarrhea.

Poynton¹ also writes upon the same subject. He begins with diluted milk and quickly increases the strength to the child's capacity. His original work upon the subject was to combat the danger of children being kept on dilute milk too long, but he had no intention of going to the other extreme. He believes that whole, citrated milk is at times very useful, especially in dealing with the poor, for it is cheap and handy. It is often successful in correcting milk dyspepsia and has survived more expensive and much vaunted substitutes. Nevertheless, the routine and prolonged use are not advisable. Some children take cow's milk to the strength of 2 parts of milk and 1 part of water, without the citrate, and when Poynton gets to that strength, he always tries to diminish the citration with a view to its suspension. The use of very dilute milk with large quantities of citrate of soda may result in general anasarca and convulsions. It was never intended for use in large quantities in dilute milk. If a child is so delicate that it is thought advisable to feed it upon very dilute cow's milk, it is not wise to try to increase the digestibility of the milk with large doses of citrate of soda.

Modern practice has been in the direction of using much higher proportions of protein than was formerly thought wise or safe. It is interesting, therefore, to inquire whether this custom is justified by our present knowledge of the digestion of protein by the infant, also whether it is advantageous or whether its use is fraught with some disadvantages or possible dangers not apparent on the surface. These questions are considered by Holt,² who bases his conclusions upon experiments made under his care at the Babies' Hospital, as well as upon observations made by others. The success which has attended the use of formulas made from whole milk has not been entirely due to the fact that the fat disturbances have been avoided, but that by greatly increasing the protein we have come much nearer supplying the infant's actual amino-acid needs for growth, especially in lysin and cystin. The excess of other protein food is apparently not injurious.

Holt's general conclusions are: That the digestion of the protein of cow's milk is a much easier matter than was formerly supposed; that while injury may without question be done by high protein feeding, it is unlikely to occur unless amounts much in excess of those commonly used in infant feeding are administered; that in such amounts we have neither clinical nor laboratory evidence to show that protein is harmful; that although an infant receiving breast milk takes rather less than his

¹ Practitioner, June, 1916.

² Archives of Pediatrics, January, 1916.

7 per cent. of his calories as protein, this cannot be taken as an exact criterion of how much protein should be administered when cow's milk is used; that the deficiency of cow's milk casein in certain essential amino-acids may be made up by giving an excess of this protein.

There remains for brief consideration the clinical use which may be made of these facts, not in the feeding of the healthy infants, but in the diet of those who are suffering from the most common forms of digestive disturbances—intolerance of fat or carbohydrates, or both. The great advantages of high protein feeding and the extent to which proteins are borne, we have only recently appreciated. That an infant of only four or five months can easily tolerate a milk mixture containing as much as 3.5 or even 4 per cent. of protein has been to most practitioners a surprise, especially when the protein given is nearly all casein. In Holt's experience, in actual acute disturbances, it is the carbohydrates that are most frequently at fault, and sugars are even more badly borne than starches. Milk-sugar seems to cause more disturbance than any other form of carbohydrate. It is for such cases that Finkelstein's milk modification—best translated into English as protein milk—is so valuable. Its usefulness is seldom enhanced by preparing it from skimmed milk, but, in Holt's experience, rather the contrary; for its relatively high fat is usually tolerated without difficulty when very low sugar is given. The preparation is to be regarded as a therapeutic agent, not a method of infant feeding; but it is one of the most valuable additions to our resources that has been made in recent years.

The newer facts regarding the proteins are bound to have an important influence on our future study, not only of the role of protein in feeding, but in putting much more clearly before our minds the fundamental requirement of protein in nutrition. No longer must we be content to consider the total amount of protein given, for it has been shown that this is often a matter of secondary importance. For the pediatricist there is opened up a new field of investigation in the problem of artificial feeding which seems to be full of promise.

In considering the *role of fat in infant feeding*, Morse¹ calls attention to the fact that the infant's normal food contains from 3.5 to 4 per cent. of fat, which would seem to indicate that it is a necessary element of food. There being no reason why the normal infant should not take fat in its food, and many good reasons why it should, the next question is, How much should it take? As much as it needs to satisfy the caloric requirements, which should be met by fat and not enough to tax its digestive capacity for fat. How much is this? Nature has decided that in human milk it is from 3.5 to 4 per cent. Experience has shown that after the first few weeks of life this is the optimum amount for the artificial food for the normal infant. The average normal infant can-

¹ Archives of Pediatrics, January, 1916.

not only take this amount of fat without injury, but it needs it in order to thrive properly. Many infants will, of course, thrive on less, provided a sufficient amount of other food elements is given to make up for the deficiency in fat, because the limits of tolerance for the various food elements are, in the ordinary infant, fortunately moderately elastic. Relatively few babies will thrive continuously, however, on more than 4 per cent. of fat. More than this should not be given, except temporarily and for definite reasons. Many babies have been made ill, however, as the result of being given larger amounts, and it is largely because of this improper use of fat that the prejudice has arisen in this country against the use of fat in infant feeding.

Another cause of the prejudice against the proper use of fat in infant feeding is the fact that physicians have failed to distinguish between normal and abnormal infants. What is proper in normal infants may be improper, inadvisable, and perhaps harmful in the abnormal. The arguments which justify the use of reasonable amounts of fat in the food of normal infants do not apply in the case of sick infants. It is self-evident that infants that have developed an intolerance for fat cannot take, without injury, the amount of fat which normal infants need in order to thrive. It is equally self-evident that when there is an excessively acid condition of the intestinal contents, whatever its cause, the products of the decomposition of fat, which are not acid, will make the condition worse and increase the symptoms. When considerable amounts of fat are given under these conditions, bad results will necessarily follow. They merely prove that the improper use of fat, as of other food elements, does harm.

RHINOLOGY, LARYNGOLOGY AND OTOTOLOGY.

BY GEORGE M. COATES, M.D.

Rhinitis. THE ETIOLOGY OF ACUTE RHINITIS, or common cold in the head, has long been a matter of dispute, being deemed by many to be bacterial in origin, as indeed the epidemiological evidence would seem to clearly indicate, while there are times when the cold appears to be due to exposure alone, as the physiologists believe. Additional evidence of the infectious character of this disease is produced by Foster,¹ whose work would seem to show that at least some "colds" are not due to the well-known microorganisms to which they are commonly attributed, but to a filterable virus which he has demonstrated in a number of cases. Unfortunately, these "filter passers" are so minute that great difficulty attends their study and classification. Foster's experiments followed the lines of Kruse.² Taking 3 cases of well-marked acute rhinitis in its early stages, secretion was blown from the nose into a sterile Petri dish and mixed with 10 c.c. sterile 0.8 per cent. salt solution. After agitating for ten minutes this mixture was passed through a Berkefeld N filter, which was impermeable to ordinary bacteria. Plates inoculated with this filtrate failed to show any growth under all conditions. Ten men in good health were now inoculated by placing a few drops of this filtrate in each nostril, and 9 of the 10 developed all the symptoms of a severe acute coryza in from eight to thirty hours. These experiments seemed to indicate clearly that the infective agent was a filterable virus, and an attempt was made to cultivate it after the method of Noguchi. The medium that was most serviceable was tissue-ascitic fluid and tissue broth. Tubes containing these media were inoculated with 5 c.c. of the nasal secretion filtrate, which was introduced into the bottom of the tube, and incubation carried out. At the end of twenty-four hours a distinct, filmy, grayish-white, opalescent halo was observed, which was sharply demarcated from the clear fluid above. Control tubes did not show these characteristics. Foster has been able to carry his subcultures to the fourth generation with ease, these subcultures having the same characteristics as the primary ones.

Examination of these cultures under the dark-field microscope revealed myriads of minute, highly active bodies which appeared to

¹ Journal of American Medical Association, April 15, 1916.

² München. med. Wehnschr., 1914, lxi, 1547.

be truly motile and not simply showing Brownian movement; and the conclusion is reached that they are microorganisms, although stained smears showed nothing that could be so identified.

When, however, inoculations were made from subcultures of seven days' growth, after a dilution of about 1 to 90,000 and passed through Berkefeld N filters, and such filtrate tested for sterility by approved methods, 11 patients who volunteered for the experiment all developed acute coryza in from eight to forty-eight hours. As cultures made from these cases showed the same characteristics as the original ones, it would seem as though the case was in a fair way of being proved.

From these experiments it is concluded that common colds of a certain type are infectious; that the causative virus occurs in the nasal secretions and is capable of passing a Berkefeld N filter, the resulting filtrate causing identical symptoms on being deposited on healthy mucous membrane. If indeed the case has not been proved by ocular proof that definitely recognizable microorganisms exist in the cultures, the results are, to say the least, significant, and must be borne in mind when failure to control cases of acute rhinitis by vaccines containing the usually accepted types of cold producers has occurred.

Little has been added during the past year to the technic of the **Submucous Resection of the Septum**, nor can much be anticipated, since it has in all probability crystallized into a standard procedure, almost all operators following, in all essential details, the original Ballenger exposition of the subject, with more or less immaterial modifications to suit individual preferences. Many perforations, however, must continue to occur as the result of exceptionally difficult cases, and at the hands of beginners, and in these instances a procedure recommended by F. O. Lewis,¹ following the suggestion of Simpson, offers a way out of the dilemma without the occurrence of a permanent perforation, which is regarded, with some justice, with horror by all operators. It must not be forgotten that it is never fair to condemn an operation as having been unskilfully performed because the case is seen afterward with a perforation, for it is not an occurrence of extreme rarity to have an ignorant patient perforate his own septum with the finger-nail days, weeks, or months after the operation, and in luetic cases the septal flaps will literally melt away at times. I have myself seen several such instances in my own practice and in that of others.

In such cases, when a complete perforation has taken place during the operation, in small perforations, regardless of cause, or in deviations in which the exigencies of the case require the removal of the anterior free border, thus removing the support of the tip, Lewis practises transplantation of cartilage, taken either from the septum under operation or from another healthy patient being operated upon at the same

¹ Journal of Otology, Rhinology, and Laryngology, September, 1915.

time, as is frequently done in large clinics. The method is commendable for its simplicity and for its success in his hands, having been used in 12 cases, in all of which the cartilage transplant lived, and the wound healed perfectly without permanent perforation. Cartilage for use in this manner is washed as soon as removed and placed in warm, sterile salt solution, and, when ready for insertion, trimmed with scissors to the proper size, inserted between the flaps and retained by light and careful packing. Cleanliness is essential, but, even if infection occurs, free drainage will preserve the life of the transplant. If all of our younger operators would bear this in mind, many permanent perforations could doubtless be avoided.

As to the end-results when this operation is undertaken for the relief of nasal obstructions in growing children, there has been a great deal of controversy in preceding years, many operators believing it unjustifiable. C. H. Hayton¹ throws light on the subject by an investigation into the results of these operations on children in the Royal Infirmary, Edinburgh, for the seven years, 1908-1914, inclusive. All of these operations were done by Logan Turner and J. S. Fraser, under general anesthesia, chloroform for the most part, augmented by a hypodermic of morphine and atropine, and local packing with cocaine and adrenalin. The ages of the children ranged from six to fourteen years, and the technic of Killian was followed with slight modifications. During these years, 73 children were operated upon, of whom 53 were either seen recently in person or sent full reports. No perforations were found or reported, and in all cases marked improvement in the symptoms for which operation was performed and in general health had occurred. A certain amount of physical deformity appears to have followed the operation in 35 per cent. of the cases, although in no case was it marked enough to seriously offset the great benefit experienced. This is the great point about which so many rhinologists have been timid, and it would appear from this series, which is large enough to be of some value, that it is not so serious after all. When deformity did occur, it was, as would be expected, a broadening and flattening of the nose or a dip at the lower ends of the nasal bones, or both.

Many methods of *after-treatment of the mucoperichondrial flaps* in the submucous septum operation have been tried with more or less success in abandoning the tight packing of the nostrils to keep the flaps in apposition, some operators preferring to do without any device for the purpose, though most have clung to the old method. Ingenious devices, more or less complicated, have been advanced for this purpose, such as a modification of different forms of paper fasteners with special tools for applying and releasing. F. C. Todd² presents us with a *metal clamp* of simple construction and easy application and removal

¹ Journal of Laryngology, Rhinology, and Otology, April, 1916.

² Journal of American Medical Association, April 29, 1916.

that should prove of great use. His claim that it is much more comfortable than packing can be readily believed by those who have undergone or seen the discomfort produced by packing in any form; and it is said to control hemorrhage equally well. If it is true, as claimed by some, that nothing is needed to control hemorrhage, which, however, I cannot substantiate by my own experience, then it certainly should find favor.

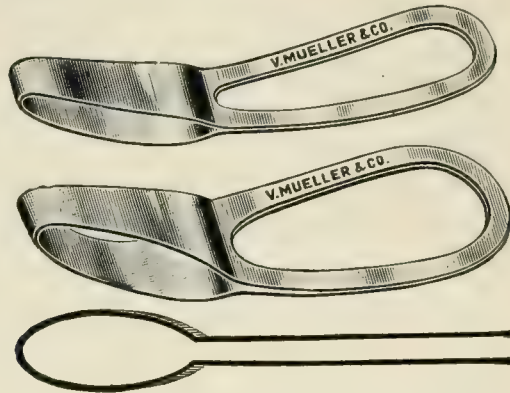


FIG. 16.—Nasal septum clamp or splint.

Galvanocautery. By general consent the use of the galvanocautery has been rigidly confined to the lower turbinate, but for one reason or another many rhinologists fail to get relief by its use from nasal and Eustachian tube obstructions and frequently prefer cutting operations upon these structures. Greenfield Sluder¹ describes a technic for a GALVANOCAUTERY OPERATION FOR THE LOWER TURBINATE that has proved eminently satisfactory in his hands in over 1000 cases, and which differs in several essential details from the linear incisions usually employed with such indifferent results. As to the superiority of the cautery over a cutting operation, he makes the points that in the former there is much less likelihood of hemorrhage and the attendant discomfort and danger of packing; there is, as a rule, less reaction from the cautery; there is no disturbance of bone; and that it deals with tissues that cannot be dealt with by the knife, *i. e.*, the pad of swollen tissue that often extends upward and backward on the nasal process of the maxilla, and a similar condition extending from the posterior tip to and beyond the Eustachian tube mouth. In the procedure about to be described, the cautery is used at such an intense heat that it instantly burns out if removed from the tissues, and the current is frequently broken to avoid great pain when in contact with the bone, which is always the depth of the incision, and to increase celerity of operation. With the nose and palate cocainized, but not shrunk with adrenalin, a self-retaining palate retractor is placed in position, and with the aid of a mirror a long curved electrode is introduced and a straight line burned along the internal surface of the posterior tip of the

¹ Laryngoscope, March, 1916.

turbinate, extending to the anterior cartilage of the Eustachian tube. To this is added two curved incisions on the body of the turbinate, one above and one below, each beginning 1 to 1.25 cm. in front of the posterior tip and extending backward to meet on the lateral wall just at the tip. Operating then from in front and using a V- or U-shaped tip in the manner of a spokeshave, a broad, linear incision is made to the anterior end of the turbinate, frequently removing in this way large portions of hypertrophied soft tissue. To complete the operation an incision is made over the nasal process, beginning in front of the middle turbinate, meeting the anterior end of the anteroposterior incision, and extending to the lower level of the inferior turbinate. No dressing is employed and there is little scabbing or dryness afterward. The results of this method are said to be infinitely more satisfactory than either the standard cautery or the cutting operations, both in regard to the patient's comfort, the relief of nasal obstruction, and catarrhal deafness due to inflammation of the Eustachian tube.

Under the heading of the use of cautery, it may not be out of place to again call the attention of the profession to the *nasal treatment of dysmenorrhea*. True, the agent used here is preferably, according to Emil Mayer,¹ chromic acid, although Fetterolf and others have substituted the *electrocautery* with good results. Whatever the connection may be between the female genitalia and certain areas of the nasal mucosa, Mayer confirms the facts noted by MacKenzie, in 1883, Fliess, in 1897, and himself, in 1914, in their practical application for the relief of dysmenorrhea. The genital spots are located on the tuberculum septi of each side opposite the anterior end of the middle turbinates and the inner part of the anterior end of the inferior turbinates. If in a case of dysmenorrhea, during the painful period, application of cocaine to these spots ameliorates the discomfort, great hopes may be entertained of a permanent cure. The *treatment* consists of applications of trichloracetic acid to the genital spots at five-day intervals during the month preceding the next menses. At each visit the slough from the preceding cauterization is rubbed off and further acid applied. Sometimes it is necessary to repeat the month's course of treatment more than once, but in a series of about 100 cases, Mayer reports a very large proportion of success. This treatment is distinctly in the domain of the rhinologist, since the average gynecologist is unprepared and unable to make these applications himself, and it would be interesting if more workers in both specialties would take it up and report results. To quote the author's own words from his previous paper, and which he says are still applicable: "Permanent relief is obtained by intranasal treatment in from 50 to 75 per cent. of the cases; the trichloracetic acid applied four times at proper intervals between

¹ Laryngoscope, February, 1916.

the periods is usually sufficient to obtain lasting results, and finally it affords an additional field of usefulness to the rhinologist."

Nasal Hemorrhage. Numerous devices have been offered to determine the COAGULATION TIME OF THE BLOOD before operating, and laryngologists have been deeply interested in them, since it has been their fate, while doing tonsillectomies, to discover most of the cases of delayed coagulability, always embarrassing and at times tragic, when they occur. This indeed has been the *bête noir* of the tonsil operator. M. W. Lyon¹ offers what he describes as a simple *method for estimating this clotting time*. The outfit required is the Biffi-Books apparatus (collapsible aluminum cup and cover; two pairs of notches cut opposite one another in the top rim of the cup; two pieces of platinum wire each with four loops). The cup is filled with water warmed to 37° C. to within 1 cm. of the top. Quickly flowing blood having been obtained, the loops are touched in it, the wires suspended in the notches of the cap, and the cover laid on. At the end of two or three minutes the cover is removed and one loopful of blood gently immersed in the water, and the procedure repeated at minute intervals until the blood fails to wash out of the loop, when the elapsed time is noted.

For those cases in which this condition was only discovered after operation, numerous expedients have been tried, but the use of sera—human, horse or from other animals—seems to stand the test of time, and is certainly more available than some others. H. H. Forbes² reviews the TREATMENT OF HEMORRHAGE WITH NORMAL BLOOD SERUM, and reports numerous successes. Serotherapy is based upon a physiological observation that blood, having been rendered non-coagulable for experimental purposes, frequently recovered its coagulability when fresh normal serum from another animal was added to the contents of the test-tube. Sera from various animals seem to have equal effect upon the coagulability of the blood even in cases of hemophilia, the serum of another hemophiliac proving satisfactory. Sera must be freshly drawn and prepared, and human serum has the advantage over others that it does not cause anaphylaxis, no matter in what doses employed as sometimes occurs when blood from other animals is used. However, in view of the millions of injections of diphtheria antitoxin given yearly, with very few dangerous symptoms, this danger must be fairly remote; and in this connection the use of antitoxin itself in hemorrhage, as suggested by Weil, is satisfactory, the horse serum and not the diphtheria antibodies, of course, accomplishing the result. It has the great advantage that it is readily procurable. Rabbit serum is very satisfactory and easily obtained, though only enough for one injection can be drawn from one rabbit. A case reported by Packard, at the Pennsylvania Hospital, some years ago, in which rabbit serum

¹ Journal of American Medical Association, March 8, 1916.

² Annals of Otology, Rhinology, and Laryngology, March, 1910.

was employed to stop a hemorrhage following tonsillectomy that had resisted all other methods of treatment, I remember well. Forbes states that precipitated blood serum, in the form of powder, has yielded good results, either as local applications to bleeding surfaces or for internal injections, and it is claimed that such powders retain their efficiency for longer periods of time than the whole sera. Horsley has suggested and used the application of living tissue to bleeding surfaces; and a prominent surgeon recently told me that it is his custom, when operating and annoying hemorrhage is present, to simply press a piece of freshly removed tissue on the spot for a moment, when all bleeding will cease.

Ozena. Following the methods of Perez, Hofer and Kofler, Horn and others commented upon last year, other experimenters have come to the fore with further proof that Perez coccobacillus is the etiological factor in atrophic rhinitis, and C. L. Klenk¹ has obtained excellent results with his own vaccines. Whereas Hofer and Kofler, Horn and most other experimenters have used stock vaccines, made polyvalent from as many strains as could be obtained, Klenk makes an autogenous one for each case and believes in this manner that better results are obtained. He also has been able to substantiate Hofer's agglutination tests in every case that he believes was true ozena.

In the early days of the ozena investigation, it was thought that it might be a local manifestation of a syphilitic or tubercular process. While, undoubtedly, many cases of fetid rhinitis are really nasal lues, and nasal tuberculosis may mislead in some cases, the idea that real ozena belonged to either of these diseases has long since been given up, and it therefore came as somewhat of a shock to find Dan MacKenzie, Mackeith, and Wingrave² again advance what they consider strong proof of its tubercular origin. They believe that the claim for specificity of the Perez coccobacillus has no foundation because it occurs in nearly every case of ordinary nasal catarrh, in the tonsils and about the teeth and in other conditions remote from atrophic changes. It was, besides, far from constant in many ozena crusts examined. On the contrary, it was found that acid-fast bacilli, many of them morphologically identical with the tubercle bacillus, and even alcohol-fast, were found in every case of true atrophic rhinitis. True ozena is described as having these essential constants: An especial fetor, enlarged nasal passages, dark, dry "crusts," anosmia and diminished sensibility, disappearance of *all* lymphoid structures.

The odor is believed to be associated with the small *coccobacillus fetidus*, but may also be due to varieties of *proteus*.

The most significant point made by these observers is from their inoculation tests in rabbits, in which 5 out of 8 injected with an emul-

¹ Journal of American Medical Association, May 20, 1916.

² Journal of Laryngology, Rhinology, and Otology, May, June, July, 1916.

sion from a case of ozena developed lesions which were undoubtedly tubercular. They claim, therefore, that this investigation has shown that a certain acid-fast bacillus is present in every case of true ozena, is never found in any allied conditions, and possesses a close morphological and tinctorial resemblance to the tubercle bacillus; that the histological changes resemble those of a tuberculous condition (lupus erythematosus) and that animal inoculations produced lesions indistinguishable from tuberculosis.

Although two pustulates, demonstration of the organisms in the diseased tissue and production of the disease in an inoculated animal, have not been complied with, they conclude that they have demonstrated that atrophic rhinitis is a disease closely allied to tubercle, and that its subjects are purveyors and distributors of an organism which is probably a variety of the tubercle bacillus.

This bacteriological investigation of Wingrave's was accompanied or preceded by the statistical and clinical studies of Dan MacKenzie and Mackeith, and the whole is worked into results that, on the face of them, sound convincing and call for further study in spite of the results of other workers attributing the cause of atrophic rhinitis to organisms very different from the tubercle bacillus. Mackenzie's summary of the results of this portion of the study is that:

1. In the majority (68 per cent.) of postmortem examinations upon ozenatous patients, pulmonary tuberculosis was found to be present.

2. Clinical examination of ozenatous patients revealed manifest tuberculosis in from 20 to 58 per cent. of the cases.

3. The family history of ozenatous patients showed the existence of family tuberculosis in from 46 to 90 per cent. of the cases.

4. The von Pirquet reaction was positive in 80 per cent. of cases under fifteen years of age.

5. The tuberculin (hypodermic) test was positive in 94 per cent. of cases tested.

The inevitable conclusion is therefore reached from the above summary that some definite causal relationship exists between these two diseases, and from the argument it is believed that ozena is in some way a manifestation and a product of tuberculosis, and this is to a certain degree confirmed by the *tuberculin treatment*. In the hands of Mackeith, and in 13 cases, the results were: Great improvement in 7; improvement (loss of fetor, disappearance of crust formation, diminution of discharge, and, often, return of sense of smell) in 3; improvement, followed by relapse, 2; no improvement, 1. It is noted, in passing, that on the cessation of treatment there was manifested a tendency to relapse, such as has been observed by most users of the different forms of immunotherapy in this disease.

The final conclusion reached, in which all three authors concur, is "that ozena, as we see it in England, is a manifestation of tuberculosis."

They admit, however, as suggested by Horn, that there may be two types of ozena clinically identical, but etiologically different, which might explain the good results obtained by treatment with vaccines made from different organisms. For instance, A. R. Friel¹ obtained good results by the intravenous injection of a sensitized, *living* vaccine of Friedländer's bacillus. The vaccine was sensitized in the usual manner, washed and reëmulified. Small doses were used to avoid severe constitutional symptoms, only 2,000,000 being the initial dose, to be repeated without increase every three or four days. When the same vaccine was given hypodermically, little benefit was observed. The idea of giving a vaccine intravenously has been shunned by most of us who have been interested in this form of therapy, through fear of untoward consequences, possibly without foundation. For the most advanced typhoid fever treatment calls for this method of administration, and the severe reactions following are hoped for and regarded in a favorable light. It seems possible that some of the doubtful results obtained from vaccine treatment may have been due to too great caution in this respect, following the teaching to avoid severe reactions. However this may be, when it comes to the intravenous injection of *live* organisms the bravest might well hesitate, although it has for some time been my own opinion that it might prove the surest and shortest way to a cure. My belief was founded upon a published case² of chronic suppurative otitis media, with complications, cured by one hypodermic injection of a vaccine that had, through a laboratory blunder, been sent down unsterilized.

But one other theory about these different results is tenable, and that is the one advanced by Jobling and others, of a basic proteid, common to all bacterial (and non-bacterial) life, the utilization of which will affect all diseases of bacterial origin. This new idea would explain many otherwise incompatible successes, including those obtained from the use of stock vaccines, but it would sound the knell of specific curative vaccine therapy.

Henry Horn,³ with E. A. Victors, has continued the work upon the *Perez coccobacillus*, reported in these pages last year, confirming many points then made and apologizing for the somewhat pessimistic tone of the former communication, since they are now "convinced that the solution of the etiology of ozena is almost at hand and that very satisfactory results can be hoped for in the treatment of this disease by vaccine." They believe they have proved that the original contention of Perez, that the coccobacillus ozena fetida is the true and only cause of ozena, is correct, and that it has no relationship with any of the Friedländer group, including the bacillus of Abel, although these two

¹ Lancet, January 22, 1916.

² Annals of Otology, Rhinology, and Laryngology, December, 1915.

³ Ibid., June, 1916.

organisms exist side by side in the nose and typical examples of each are often seen on the same slide. It is noted that, as the case improves clinically, the Friedländer bacillus takes the place of the Perez bacillus and seems the last to clear up. And, furthermore, they announce that the organism of Perez is distinctly motile and flagellated, this characteristic having been observed in every strain, 29 cases. The flagellæ are easily stained. Positive complement-fixation tests with the bacillus bronchosepticus (the cause of distemper in dogs) put it indisputably into the class with these organisms.

For the present they believe it convenient to divide clinical ozena into a Friedländer group and a Perez group, according to the bacteriological findings, until the clinical relation of the Friedländer to the coccobacillus and its etiological role can be determined; but, so far, 58 per cent. of cases gave pure cultures of Perez's organism and 42 per cent. Friedländer, and the preponderance of the former is continually increasing under better methods of study. So far, neither the Perez bacillus nor the bacillus of Abel has been found in the normal nose or in cases of simple atrophic rhinitis (non-ozenatous), although other members of the Friedländer group are frequently found.

Perez bacillus has been isolated from all parts of the mucous membrane of the nose, including the sinuses, and from the submucous tissue; and when cultures taken from the surface revealed only the ordinary saprophytes, it was found very easy to get pure cultures of the coccobacillus from the underlying structures. As this is an important statement, and will explain many failures to obtain this organism, the method is quoted in detail as follows:

"The turbinate was first cocainized, then painted with pure tincture of iodine. A heavy needle, attached to a Luer syringe, was punctured through the iodine area and the needle withdrawn and a bouillon tube inoculated. The tube always remained sterile and showed that no organisms were carried into the submucous tissue by the needle. The needle was again punctured through the iodine area, the point moved about, near or below the periosteum of the turbinate, until a slight hemorrhage had taken place, and then the plunger partially withdrawn. The few drops of blood were placed in bouillon, and usually, in the genuine ozena cases, a pure culture of the Perez bacillus was obtained. These experiments were repeated on both the inferior and middle turbinates."

While the sinuses are not believed to play any part in the incidence of the disease, it is undoubtedly true that the process spreads to the various accessory cavities, and it would seem good policy, before attempting vaccine therapy, to thoroughly drain all of them that need attention. This was not done in the cases reported in order not to confuse possible causes of cure. It was found, however, in several cases in which the odor persisted after the nose had apparently cleared

up, that there were collections of pus in the sphenoids and antra, and, when this was removed by lavage, no further objective symptoms were noticed.

In the matter of dosage, great pains are taken to select that one proper for the individual under consideration, since it varies greatly in different patients. An initial dose of 200,000,000 is used, and the patient inspected in twenty-four hours. If no reaction symptoms are reported, 400,000,000 are administered and the patient again examined in twenty-four hours for reaction. This is continued, doubling the dose every day until definite symptoms of reaction are obtained (headache, general malaise, poor appetite, fever, and nausea at times) and this dose is considered the minimum therapeutic dose and is usually 800,000,000. Thereafter the dose is increased by 200,000,000 or 400,000,000 at seventy-two-hour intervals unless reaction occurs, when the increase is temporarily omitted or the interval increased. Improvement should be unquestionable after the fourth dose produces reaction. The strains for these vaccines are selected by agglutination tests and their potency increased by passage through animals, but this increased work makes it necessary to adhere to the plan of using stock vaccines of their own preparation rather than autogenous. It is urged that to get results the dosage must be pushed to the extreme limit of reaction, and it is remarkable how quickly patients will become almost immune to subsequent doses, however large. No harm has been observed from this method, even in young children.

Hay Fever. Hay fever, from having been one of the reproaches of the rhinologist, bids fair, from the amount of investigation and research that has been done in recent years in respect to its etiology and therapy, to become a problem successfully solved, although it cannot be said that this desirable termination has yet been reached by any means. However, progress seems to be taking place, and more and more reports of the successful results of pollen therapy as well as of other forms of treatment are being published, while prophylactic measures for diminishing the supply of irritating pollen are under way in various parts of the country.

The American Hay Fever Prevention Association has been most active in this work and is at work on a propaganda to do away with the most pestiferous pollen-disseminating weeds, which in any case are a nuisance to the farmer and the cause of a large money loss the country over. W. Scheppegrell¹ reports that the characteristics of hay fever weeds are that they are wind-pollinated, very numerous, and the flowers are inconspicuous, without bright color or scent, and pollen is formed in large quantities.

All weeds having the above characteristics are suspicious, but the

¹ Public Health Reports, July 21, 1916, xxxi, No. 29.

pollen must cause distinct reaction when placed on the conjunctiva or nasal mucosa, and it must be wind pollinated to be classified as a hay fever producer. Both of these tests are required to establish the toxicity of a weed, since, no matter how irritating the pollen may be, if it is not wind-pollinated it can do but little harm. In the latter class is placed the rose and golden-rod, as being comparatively harmless. It is estimated that 85 per cent. of all autumnal hay fever is caused by two varieties of rag-weed, and it is urged that united action be taken to exterminate them. This can hardly apply to the grasses, which cause a certain percentage of reaction in this country and more in Europe, where the rag-weed is not found. Gigantic as the task may appear, when it is considered that from 1 to 2 per cent. of the population suffer from hay fever, it may seem worth while, especially since it has met with some degree of success where it has been tried, notably in New Orleans. A number of the States have passed anti-weed legislation, and it is urged that wide-spread publicity be given this movement to solicit the aid of everyone in reducing the cause of this plague. To aid this propaganda, a sheet of general instructions for hay-fever sufferers has been sent out by the association, which can be obtained from the United States Public Health Department by anyone interested.

W. Scheppegrell,¹ reporting for the research department of this association, makes some interesting statements that, so far as I know, have not appeared before. This report deals with the *relation of the physical formation of pollen to the reaction caused by it*. Investigations demonstrate that the reactions vary not so much in the degree of susceptibility of the patients to pollen as in the form of the pollens themselves. There appear to be two physically distinct classes of pollen; in the first of which the outer coat is covered with minute spicules, and the second in which they are absent. The spiculated pollen grains are usually, but not always, spherical, as in the rag-weeds, cocklebur, etc. The types of unspiculated pollen-bearers are the corn and the grasses. Tests show that in a person sensitized to any one of the first group a severe reaction is invariably caused by the inhalation of any pollen of this group. If, then, any of these plants are wind-pollinated they are a cause of hay fever in a sensitive subject. The reaction is prompt and active, occurring within two minutes; if it does not take place, the patient is not sensitive to the pollen or it has failed to reach the mucosa. The reaction, moreover, is in direct proportion to the length of the spicules.

In the unspiculated variety the reactions are less marked and delayed, though they may be prolonged, and are caused by the absorption of the protein contents of the pollen and are in direct proportion to the amount of protein contained. Likewise, all of these pollens with a high protein

¹ Journal of American Medical Association, September 16, 1916.

content invariably produce a reaction in a subject sensitized to any one of them. These facts should have an important bearing upon future investigations for desensitizing sufferers with pollen extract and would make it seem probable that multiple tests and multiple inoculations might not be any more necessary than they are desirable. Scheppegrell further states that "the increased susceptibility of the patient to pollen after the first inhalation of spiculated pollen is not due to anaphylaxis but to the increased sensitiveness of the nostril resulting from the irritation." He recommends frequent sprays of oil (unmedicated) of a low specific gravity to soften the spicules and diminish the irritation.

Of first importance in the prophylaxis is the destruction of weeds in the neighborhood, which has proved most effective in New Orleans. The patient is made to carry a glycerin-covered plate, to which the pollen in the air adheres. This is then examined to determine the infecting pollen. An inspector is next sent out for a given distance in each direction to locate the parent plants, and these, when found, are reported to the health officer, who orders their extermination.

A. Parker Hitchens¹ believes that specificity is of great importance in the treatment of hay fever, although he admits it is open to question, quoting Goodale on the subject. He has devised a brooch frame to which is attached a glycerin-coated cover-slip, the device to be attached to the clothing of the subject in order to gather pollen. After a given number of hours, this cover-slip is detached, mounted, and examined under the microscope.

Oppenheimer and Gottlieb,² who last year reported upon a small series of cases treated with *pollen vaccine* after determining the infecting pollen by means of skin reactions, give their results in a larger series of cases during the summer of 1915. They are most enthusiastic about this form of prophylactic therapy, and state that of 32 cases of spring pollenosis treated by them, symptoms of the disease developed in only 2. Of the fall cases there were 62 treated; 52 of them had treatment well in advance of the expected attack and 15 were definitely free from symptoms; 25 markedly improved; and 12 were in no way benefited, unless the attack took place rather later than in previous years. Of the group of 10 who undertook treatment after the attack had commenced or just before, 4 appeared decidedly benefited. The authors sound a note of warning, which has been repeated by others, that large doses of pollen extract may give rise to very alarming and dangerous anaphylactic reactions.

G. H. A. Clowes³ confirms the results quoted above and says that at least 50 per cent. of cases in his hands have derived marked benefit from pollen extracts. His records show that subjects treated for three

¹ Journal of American Medical Association, September 16, 1916.

² Medical Record, March 18, 1916.

³ Transactions of American Laryngological Association, 1915.

or four years in succession show that a greater alleviation of symptoms is obtained in each succeeding year of treatment. He also fears anaphylactic shock from overdosage. Commenting upon the use of *calcium salts*, he states that while some patients showed very remarkable improvement with their use, in others there was practically no effect produced. Harold Wilson¹ compares the results of two series of approximate numbers treated respectively with pollen extracts and with calcium chloride. His results were largely in favor of the calcium. Of 21 patients treated with pollen solution in two years only, 1 had entire relief from symptoms and 3 were markedly improved; while with calcium in 22 cases there was total relief in 5, marked relief in 15, and no results in but 2. The calcium chloride is administered in 1 gm. doses three to six times a day, and is well tolerated. Wilson emphasized the difficulty in collecting the pollen for therapeutic purposes, and R. P. Wodehouse² contributes a simple method of *obtaining rag-weed pollen in large quantities*. The flower-heads of young plants just coming into bloom are stripped, dried, and crushed in a mortar with several volumes of carbon tetrachloride. After thorough maceration, the liquid is strained through muslin. Most of the pollen passes through the muslin and can be collected on filter paper and washed with fresh CCl₄. This rapid method does not interfere with the anaphylactic properties of the pollen. Only flowers from young plants just opening and collected away from dusty roadsides should be used.

J. L. Goodale,³ in an article on the *diagnosis and management of vasomotor disturbances of the upper air passages*, brings forward the possibility that certain forms of these disturbances are caused by foreign proteids of bacterial origin, and that, by skin tests, it can often be determined from which one the patient is suffering. Analyzing the causes of 340 vasomotor cases, it is found that from a clinical stand-point they can be divided into two main groups, the seasonal and the perennial. The former, of course, represents hay fever and its allied disturbances, coming at certain seasons when the given form of proteid is prevalent; but the perennial form occurs at any time of the year, and two divisions of this group are noted, the first arising from the ingestion of a foreign proteid and the second from its inhalation. The ingestion form is well-known and is typified by albumin sensitization (asthma from eating eggs). The second may be represented by the asthma caused in certain individuals by the inhalation of fine particles of horses' hair—"horse asthma." Goodale now calls attention to a third subdivision of the perennial group, which he terms infectious, because it stands in relation to bacterial invasion of the upper air passages. Individuals so affected do not present the picture of acute rhinitis with pus

¹ Laryngoscope, June, 1916.

² Boston Medical and Surgical Journal, March 23, 1916.

³ Ibid., February 17, 1916.

formation, etc., but rather the hay-fever appearance, with sneezing, watery discharge, and attacks of asthma at any period of the year. Reasoning by analogy from knowledge of the action of plant pollen and keratin proteid of animals upon sensitized individuals, he believes that the type just described may be caused by the sensitization of the individual to bacterial proteids, giving rise, when in sufficient amount, to anaphylactic manifestations. Goodale has established presumptive evidence of this contention by the employment of skin reactions, made in the usual manner, cultures from cases of vasomotor rhinitis and asthma of the apparently infectious type being used. It was found by these experiments, in certain anaphylactic individuals exhibiting symptoms of perennial vasomotor disturbances, that an immediate and characteristic reaction was elicited by the application to a scratch of the skin of soluble extracts of five different organisms isolated, and that some patients reacted to one and some to another. Individuals without vasomotor symptoms developed no reaction in any case.

Accessory Sinuses. Just as the external sinus operation has largely given place to endonasal work, so now there is a tendency apparent to do without surgery at all, or, at all events, to develop the conservative treatment of both acute and chronic suppuration of the nasal accessory sinuses. The *vacuum treatment* of these cavities is not new, and has been used with some success, but Lewis A. Coffin¹ has devised an instrument for producing a vacuum in the cavities and then filling this vacuum with medicated vapor, and claims very beneficial results from this practice. The air entering the vacuumized nose and cavities under a considerable pressure is medicated by a nebula of oil containing various remedial agents. The instrument consists of two bottles mounted on the lower side of a tube $\frac{1}{2}$ inch in diameter called the connecting tube. The long end of this tube terminates in an olive-pointed tip. Between the bottles is a switch-key by means of which the inside of either bottle may be connected with the lumen of the connecting tube, the inside of the other bottle being at the same time disconnected. Between the bottles is a small tube extending through the key sleeve for the attachment of rubber tubing to the exhaust pump. When the key is so turned as to connect the second bottle with the connective tube one is able to create a vacuum by means of the pump. This will suck out any secretions from the sinuses on one side and form a partial vacuum. The olive tip is placed in one nostril, the other closed tightly, and the patient, by pronouncing the letter K, closes the nasopharynx from the oropharynx. The first bottle is a nebulizer and is connected with the compressed-air apparatus by the usual cut-off. Contained in it is the medicated fluid. When the cavities have been sucked dry and a partial vacuum formed, the key is turned and the nebula forced in to

¹ Laryngoscope, December, 1915.

replace this vacuum, and Coffin feels convinced that much of this vapor finds its way into the sinuses. The medication suggested, and with which he has had best results, is a mineral oil loaded with Bulgarian bacilli or one of the proprietary preparations of iodine. By this means many patients have been relieved without operation, although the word cure is not used, "arrested" being the conservative term applied.

This method of introducing medicated vapors is an elaboration of that brought out by F. L. Stillman in 1913. Stillman used a hand-operated syringe to produce his suction and an ordinary compressed-air nebulizer with a simple finger release. This was modified by Harmon Smith, who reverses the procedure with a simple instrument, the vacuum being produced by a pump and the medicated solution driven

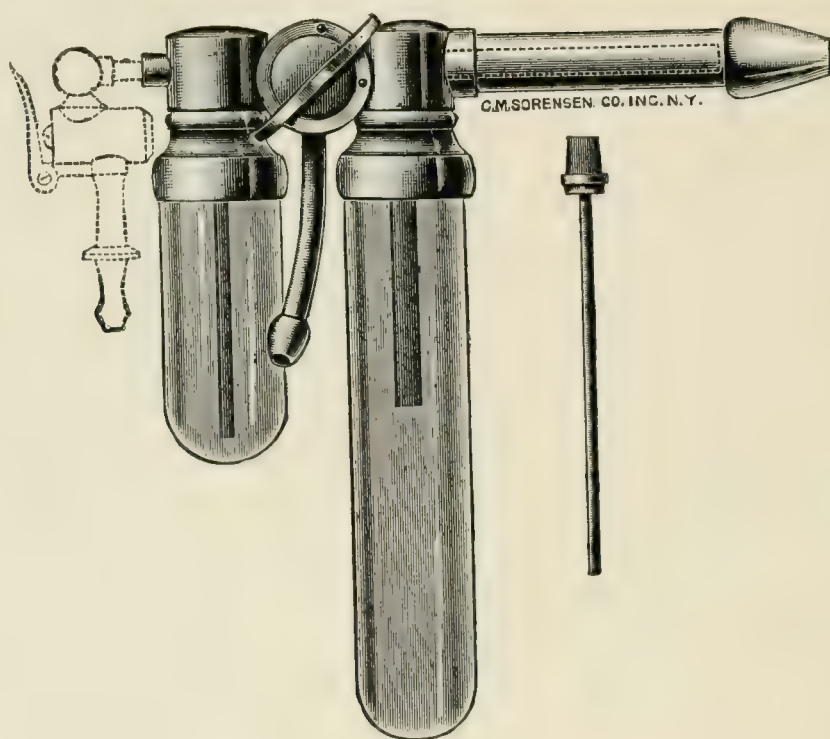


FIG. 17

into the vacuumized cavities by the plunger action of the syringe worked by hand. Iodine and argyrol in solution are favored by both of these writers, although the latter has had the best results from a suspension of the lactic acid bacillus.

A. M. MacWhinnie¹ also describes an instrument for producing a vacuum in the sinuses, consisting of an electrically driven rotary pump connected with a vacuum bottle and having a pressure gauge. Fifteen minutes is required to empty the cells of their purulent contents, but, unlike the Coffin method, the author does not use a nebula, but, instead, injects into the cavity of *each cell* with a fine pipet a 50 per cent. argyrol solution, which is to be retained for one hour. How the ostia of these

¹ New York Medical Journal, January 29, 1916.

cells are located and the injection made is not made clear, but the Coffin method is so easy that it is well worth a trial.

George C. Stout¹ lays stress on *headaches due to non-suppurative intranasal conditions*, and thinks that the intranasal origin of these pains is often overlooked. The increasing number of such nasal headaches, existing without any other apparent cause and without evidence of suppuration, attracted attention to possible turbinate pressure, and it is along this line that he has worked out a series of cases. The pain in these cases is sometimes violent, and is most often due to pressure in the middle turbinate region. This pain varies from occasional attacks of moderate degree to seizures of agonizing pain, referred to an area back of a triangle whose angles are the glabella, the outer canthus of the eye, and the anterior nasal spine. Next in order of frequency it affects the teeth, the neighborhood of the Eustachian tubes and ears, and is even found down the shoulder on the affected side. In this localization of pain, the branches of the fifth nerve are the evident carriers, and Sluder's syndrome of sphenopalatine ganglion neurosis is suggested. The pain may be bilateral, unilateral, or alternate, and is not increased by the use of the eyes nor by pressure. The nasal picture is that of a middle turbinate jammed into an area too small for it between the ethmoid labyrinth and the septum. The lower portion of the nose is usually normal, as may also be the middle turbinate itself, although at times it is congested and boggy. Stout emphasizes in these cases:

1. Slight departure from the normal rhinoscopically.
2. The importance of eliminating all other causes.
3. The routine examination of middle turbinate fossæ imperative in all unclassified headaches or even in tic douloureux.
4. The number of unrecognized cases that have filtered through most skilful hands.

For the relief of this condition, extirpation of a part or whole of the middle turbinate is necessary.

I have frequently seen cases similar to the above that could not be classified as belonging to the Sluder neurosis type, although they are often difficult to distinguish from the latter, and presumably injection of the sphenopalatine ganglion would relieve all of them. It must not be forgotten that a suppuration may be present in one or more of the sinuses, with nothing to be seen by rhinoscopic examination unless suction is applied. The *x*-ray and transillumination may also be misleading, and there are still the vacuum headaches of Sluder to be distinguished from those caused by pure pressure. Fortunately, however, the remedy suggested is applicable to all of these classes, so that the need of a most exact diagnosis is not always apparent.

¹ Transactions of American Laryngological Association, 1915

Transillumination of the Antrum. A new method is suggested by W. G. Reeder,¹ who uses a very small, but powerful, lamp guarded by a metal sleeve fenestrated at one side. This is placed between the lip and the alveolar process directly above the root of the second premolar tooth. The rays of light traverse the cavity of the antrum, penetrating the thin anterior and upper walls, giving well-defined illumination above the infra-orbital ridge and also a pupillary light reflex. In this way it is claimed that the light is thrown through the thinner walls of the antrum rather than the thick palate, and that artificial dentures do not interfere.

X-rays. The value of the *x-rays in sinus disease*, not only as a means of diagnosis but as a guide to both intranasal and external operating, have become firmly established, but improvements of technic are still being made. The sphenoid sinuses always have been the most difficult to photograph, owing to their central location and to the fact that when oblique views have been taken or they have been projected through the orbit, as practised by Pfahler, the interpretation is most difficult and at times uncertain. G. E. Pfahler² has introduced a new position with which he has been successful in obtaining good negatives without distortion. It makes use of *x-ray* films cut to the size of 2 x 3 $\frac{1}{4}$ inches, with two of the corners rounded, enclosed in black envelopes and waxed paper. The film is placed in the mouth, reaching the posterior wall of the pharynx, which may be cocaineized, if necessary, although it usually is not. The bite of the patient's teeth holds the film steadily in position. The sitting posture is adopted with the chin supported, and the rays are projected toward the film from a point in the median line midway between the glabella and the occiput, the exact position varying with differences in the shape of the skull. The exposure consists of 150 milliamperè seconds, with a current whose voltage equals a 7-inch spark gap. These plates show both sphenoid sinuses with great accuracy and detail, surrounded by the teeth of the superior maxilla. S. Iglauer³ much prefers the older oblique method for the sphenoids, but admits that the interpretation is difficult. He believes Pfahler's position impractical because the film is likely to be moved by the tongue and soft palate during exposure. M. W. Clift⁴ uses a position almost identical with that used by Pfahler, and considers it the very best for the purpose. The advantages seem to be obvious; the film lies close to the sphenoid, the object being photographed, and the tissues to be penetrated are very few. The sinus is shown undistorted and with no overlying shadows of ethmoid cells, which always obscure and confuse.

¹ Journal of American Medical Association, April 29, 1916.

² Laryngoscope, July, 1916.

³ Transactions of Section on Laryngology, Otology and Rhinology, American Medical Association, 1916.

⁴ Ibid.

The two sinuses are shown side by side on the same film for comparison, which is a decided advantage.

Sinus Operations. Since in recent years the pendulum has swung away from the RADICAL FRONTAL SINUS OPERATION with its too often consequent deformity and occasional disastrous results in regard to sight and life, more and more attention has been devoted to developing intranasal procedures that will give the maximum of relief with the minimum of danger, necessarily without external deformity; and Otto J. Freer¹ summarizes the operations of Watson Williams, Tilley, Halle, Mosher, and Ingals, and builds up, from these, his own method of draining the frontal sinus by removing, through the nose, that portion of the floor of the sinus formed by the roofs of the anterior ethmoid cells, the foveale ethmoidale. A careful review of the anatomy of this region shows that many abnormalities occur, such as difference in size and shape, or total absence, of the frontal sinus, the presence of frontal bulla cells, etc., which make any operation hazardous and the liability of failure great, without previous careful x-ray study. There is a compensating constancy, however, in the surgical approach to the sinus from the nasal cavity that may be taken advantage of, and the fundamental lamellæ of Hajek, the uncinatè process, the bullar lamella, and the middle turbinate are always present unless removed by disease or previous operation. The older operation of enlarging the frontonasal duct by cutting forward either with rasp, punch, or burr is condemned by Freer as not in reality being more safe, because the hard bone of the nasal crest makes more force for its removal necessary, with consequent danger of injury to the overhanging sinus walls. Furthermore, removal of the internal nasal crest in this manner will not give the room required for adequate drainage and will not remain open. On the other hand, ample space is obtained by removing *backward* the foveal cells from beneath the orbital plate of the frontal bone, thus greatly enlarging the ostium, since it is narrowed into a mere slit by their presence. Little force is required for this operation and only a light curet of special design is used. In this way the anatomical obstruction to drainage is removed, the sinus ostium opened to the fullest capacity, which is ample, of the frontal sinus opening in the detached frontal bone, and the work is done in a capacious part of the nose and not in the narrowest, as in the forward cutting operation. Islands of mucous membrane left in position enable the mucous membrane of the sinus to reform, at first with the squamous type of cell, which eventually becomes columnar, acquiring cilia, with the restoration of the sinus cavity to an approximation of the normal. When there are frontal bulla cells extending out over the orbit, they are beyond surgical interference (presumably intranasal) except drainage, if suppurating.

¹ Laryngoscope, December, 1915.

The portion of the orbital process of the frontal bone covering the anterior ethmoid cells is continuous with the posterior cranial wall of the frontal sinus, with which it forms a sweeping curve. The curet follows this curve in clearing away obstructing ethmoid cells. The covering is thin but hard and firm, and is in little danger of perforation unless directly attacked. Attention is directed to the thin outer wall of this region composed of the lamina papyracea, which is frail and liable to perforation with infection of the orbit unless the instruments are used in an anteroposterior direction only and little force used.

In contradistinction to the old tortuous and narrow anatomical approach to the cavity of the sinus through the infundibulum and the nasofrontal duct, beneath the middle turbinate, the broad surgical approach between the orbital wall and the turbinal plate of the ethmoid disregards all ethmoid cells in the way and extends anteroposteriorly from the ascending process of the superior maxillary bone to the lamella of the middle turbinate. The lower limit of this approach is the bottom of the bulla ethmoidalis, and the upper limit is the orbital plate of the frontal bone covering the foveal cells.

The technic of the operation is fully described.

M. P. Mosher¹ reviews his popular intranasal approach to the frontal sinus, quoted by Freer. He has abandoned the agger nasi cell, and makes his initial opening into the anterior ethmoid cells through the upper overhang of the middle turbinate, thence curetting forward, as recommended by Freer, until the ostium frontale is freed of its encircling cells, and then backward through the entire ethmoid labyrinth until the anterior wall of the sphenoid sinus is reached. There is, after all, little difference between this operation and that of Freer, except in the selection of the point of approach. Mosher mentions two deaths from meningitis following this operation in other hands than his own, but believes that any ethmoid operation worthy of the name will have some mortality. The orbit may readily be entered, and, if in the posterior position, grave results may follow, but if anteriorly, where it is most apt to occur, it is a trivial accident. When the entire labyrinth is exenterated, packing is introduced to control the excessive hemorrhage. Attention is also directed to the facts, experienced by all ethmoid operators, that for several weeks following operation there is frequently so much reactionary swelling that the appearances would suggest an incomplete operation, and that even a long time after a thorough operation it seems as if but little had been removed. My own experience leads me to believe that there is often a replacement of the ethmoid cells, with fibrous tissue formation, filling up the cavity which formerly contained the ethmoid, and restoring the lumen of the nose to its original size, thus avoiding the excessive dryness which the

¹ Transactions of American Laryngological Association, 1915.

passage of too much unmoistened air would cause. Mosher uses an alkaline wash and argyrol for after-treatment, and finds it necessary to frequently remove recurrences of polypi.

The technic of the PRETURBINAL OPERATION ON THE MAXILLARY SINUS, advocated by Skillern, was given in detail here a year ago. J. C. G. MacNab¹ finds the following disadvantages, which he proposes to do away with by modifying the original technic: (1) The dressings were always painful; (2) the opening had a great tendency to close up; (3) it was impossible to know when to leave out packing. The modification consists of freshening the mucous membrane of the floor of the antrum for about a centimeter adjacent to the nasal floor, after the completion of the operation as described by Skillern. The ridge of bone between the antrum and nasal cavity is now carefully polished down and a mucoperiosteal flap cut from the lateral wall, as in the Denker operation, folded into the antrum and packed in position with bismuth gauze. This simply is an extension of the preturbinal operation along the lines of Canfield and Denker, and should give more room if more is needed. The author claims that all of his cases thus operated upon were well within five weeks.

PURULENT LEPTOMENINGITIS OF NASAL OR ACCESSORY SINUS ORIGIN may occur with or without brain abscess, and may be associated with pachymeningitis or with extradural abscess. Comparatively few cases due to frontal sinus suppuration have been reported, mostly by the rhinologist, and S. Leopold² adds two more to the list and discusses this type of intracranial involvement.

L. H. Landon³ has called attention, in a timely article, to the ROLE OF THE RHINOLOGIST IN HYPOPHYSEAL SURGERY, reporting his personal experiences in 15 operative cases, using modifications of the Hirsch method of attacking the hypophysis through the submucous resection of the septum and the sphenoid sinuses. In view of the very general interest that the pathology and surgery of this organ has aroused in recent years among internists, surgeons, and ophthalmologists, it seems not out of place to note that this article urges that hypophyseal surgery lies within the domain of the rhinologist, since its approach by this most modern and satisfactory method is entirely through the nose and the accessory sinuses. The symptoms of hypophyseal disease have been well worked out by observers in other lines than our own, and numerous methods of attack have been devised, mostly by general surgeons who almost uniformly employed an external route, the latest one suggested being the transfrontal technic of McArthur, modified by Frazier. The anatomical difficulties in the way of any intracranial approach of the gland will demonstrate at once the seriousness of these

¹ Journal of Laryngology, Rhinology, and Otology, September, 1915.

² Jour. Amer. Med. Assn., May 27, 1916.

³ Pennsylvania Medical Journal, June, 1916.

procedures, besides the usual dangers attendant upon any craniotomy and the necessity of prolonged general anesthesia. Immediately in relation to the gland lie the optic nerves or chiasm and the anterior cerebral arteries, and in close proximity on either side of the sinuses the third, fourth, and sixth nerves and the terminations of the internal carotid arteries. Together with the dangers incumbent upon the extreme elevation of the brain and the unavoidable traumatism to the cerebral tissues, there is always a possibility of injuring any or all of these important and, to some extent, vital structures in any intracranial attack on the hypophysis. On the other hand, the sella turcica is separated from the general cranial cavity by the diaphragma sellæ, which is a process of the dura mater, while the dural covering is lacking on the inferior and partially on its lateral surfaces. The floor of the sella forms the roof and, in some cases, the posterior wall of the sphenoid cavity. Any approach, therefore, from below will avoid many of the dangers and difficulties attendant upon the intracranial routes.

The writer lays great stress upon the value of proper skiagraphic studies in any case of suspected hypophyseal lesion. He strongly advocates stereoscopic plates and insists that these are absolutely necessary before the operation can be intelligently done, since they will give definite information as to the size of the sella and its relation to the sphenoid sinuses, and the size and position of the latter in their relation to the nose and septum. The submucous approach does not permit, as yet, of complete removal of a tumor of the sella, but is limited to decompression downward, which, fortunately, however, is usually sufficient to give relief, the restoration of lost, or the preservation of remaining, vision and alleviation of the other subjective symptoms. Most of the tumors of the pituitary body are benign in character, and even the malignant processes are of slower growth compared to those elsewhere in the body, so that decompression offers at least a relative cure.

Landon believes that the normal healthy nasal passages are sterile as regards pathogenic organisms. Nevertheless, in view of the danger that would attend upon any infection in the regions to be uncovered by the operation, he is at the most painstaking care for the preparation of the nose for operations. Any inflammatory condition of the nasal passages or of the accessory cavities absolutely prohibits operation until it is completely eradicated. While Hirsch routinely performs middle turbinectomy, Landon has never found this necessary for an adequate exposure. His technic for preparation of the passages is given.

While a few isolated reports of this operation having been done by rhinologists in America have been noted from time to time, it would seem to me that it is well deserving of further study by our specialists. It would seem reasonable that a good submucous operator would have comparatively little difficulty in extending his operation so as to expose

the pituitary body, while on the other hand the general surgeon, who has hitherto done this work, must become a skilful nasal surgeon before he can attempt this operation. Careful work in the study of the cadaver, combined with the practical experience that every rhinologist has, would fit him *par excellence* for this work.

Tonsils. While the tonsil question is not as acute as a few years ago, nevertheless the literature is still full of theories of function, descriptions of *new* "bloodless" operations, all very much alike, and studies as to end-results. Many of the writers take a more or less conservative stand as opposed to the radicalism of a few years back. Stress is laid upon conservation by those who have closely studied series of tonsillectomized throats, and these observers find serious physical deformities frequently following the operation. The great mass of laryngologists, however, still believe in total enucleation, and, when the operation has been done with average skill, fail to find defects or deterioration of voice following this surgical procedure. Following the suggestion of Makuen that the main function of the tonsil was to support the palatopharyngeus and palatoglossus muscles, Kenyon and Kradwell¹ have made a careful anatomical study, supplemented by a clinical study of 43 tonsillectomized throats. They confirm Makuen's contention in the following summary of their work:

1. The tonsil serves as an absolutely necessary factor in providing a channel for the action of the palatoglossus muscle.

2. The function of the tonsil with reference to the palatopharyngeus is to afford support and protection of great importance to its normality of action.

3. Tonsillectomy serves to destroy not merely a possible lymphatic function of the tonsil but also to either disturb or destroy an important physicommechanical function, one which is capable of being clearly understood.

4. More or less impairment of action of the depressor palatal muscles must occur in practically all cases following tonsillectomy, regardless of the delicacy of operative technic or the particular form of operative procedure adopted; but delicacy of procedure and method of operation are not, of course, to be considered unimportant.

5. To consider the present operation of tonsillectomy as a final statement of the operative approach to the tonsil is premature and erroneous. The whole tonsil question requires further anatomical, pathological, and operative study, in order, if possible, to readjust the operative approach to the organ to the new knowledge which is accumulating.

Makuen² thinks the difficult part of tonsil work is to know whether or not operation is demanded, and predicts that the tendency of the future will be to find out, not how to operate, but how not to operate,

¹ Illinois Medical Journal, June, 1916.

² New York Medical Journal, March 11, 1916.

or at least how to operate in the most conservative manner. T. R. French¹ has devised an instrument for this purpose and elaborated a system of conservative surgery of the tonsil. He calls the instrument the *tonsilloscope*. It consists of one or two small, high-powered light carriers, hooded on one side and attached by cords to dry-cell batteries. In the application of this method the lights are tucked behind the cocaineized tonsil and the transilluminated organ studied for changes in color through a tube fitted with a focussing lens. As seen through this the tonsils appear of various shades of red, with more or less unevenness of color, from which French classifies them into five groups, beginning with normal. The instrument seems to be extremely simple in its application, the only difficulty being in interpreting the findings, which must really be learned by using removed tonsils transilluminated in a "microscope," or box, of his devising. To the uninitiated there is certainly a difference in the tonsils thus seen, but the meaning of it is not clear without study.

The meaning of these varieties and shades of coloring is a matter of interpretation which has been developed from experimental color studies made in association with the anatomical, histological, and pathological findings.

When the tonsil is in health, or nearly so, it is relatively translucent, but when the seat of disease it is less translucent in proportion, presumably, to the number and virulence of the bacteria in the pathogenic material present and the consequent inflammatory reaction produced by them, so that in extensive disease it is impossible to detect anything beyond collections of detritus and pus lying close to the surface.

French, from a study of 666 tonsils of children examined *in situ* and after removal, and in a large number of adults, divides all tonsils into six groups, with a description of their characteristics.

The following conclusions have been offered:

1. All enlarged tonsils in subjects above the age of eight years are diseased.

2. Enlarged tonsils in subjects below the age of eight years may, or may not, be diseased, and whether they are or not can be determined only by examination with the tonsilloscope.

3. The tonsils in subjects above the age of childhood are often, and without much doubt oftener than we now know, the seats of foci capable, under certain conditions, of producing local and systemic infections.

4. In many subjects it has been proven that they are the source of systemic infection and total enucleation holds out [the only hope of complete and permanent relief.

5. Tonsils which are the seat of extreme disease, and which are therefore seen to be excessively hyperemic, bleed freely when cut.

¹ New York Medical Journal, May, 1916.

From his extensive study of the tonsils, it was found that of enlarged tonsils below the age of eight years, 20 per cent. were tonsils of health; 25 per cent. of the doubtful class, and 55 per cent. were definitely diseased. Most of the enlarged tonsils of health were found in the second, third, and fourth years. Enlarged tonsils in subjects below the age of eight years therefore exist to the extent of at least 20 per cent., as the result of their functional activity and not because they are diseased. All enlarged tonsils in those above this age probably condemn themselves as diseased by being enlarged; but diseased tonsils are not necessarily enlarged, as is well known. In this investigation, diseased small tonsils were found in 4 per cent. in those under eight years of age. It would seem, then, that the enlarged tonsils of health in childhood may be regarded as permanently diseased if they continue enlarged after the eighth year, and not one enlarged tonsil after that age was found healthy.

One interesting conclusion reached by this study is that the revelations of this method seem to reduce the function of the tonsil to a negligible factor, for a tonsil that is diseased cannot perform its function if it has one. It was also noted that one tonsil in a throat was never found healthy when the other was extensively diseased.

With the aid of the tonsilloscope, it is possible to detect, open up, and treat individual diseased crypts with accuracy, even locked-in collections being easily discovered and removed without sacrificing the entire tonsil. Moreover, it was discovered that the inner wall of a peritonsillar abscess could be determined with ease and the pus pocket accurately opened in the very early stages, which should be of great value.

If this invention should, after trial, prove practicable, it would offer a ready means of diagnosis, so that no longer could the reproach be upon us that we remove normal tonsils. This would fulfil the requirements of Makuen as noted above. He believes in conservative surgery to the last, even if in the end the tonsil must be enucleated. Opening and draining retention pockets either in the crypts or between the tonsils and the pillars is good surgery, and in this French concurs, having devised a method for slitting and removing the plica triangularis when it covers the mouth of certain crypts on the anterior face of the tonsil. When the edges of the cut pockets tend to unite, they are seared with the cautery, or even small portions are punched out. The crypts are then washed out, sterilized, and curetted. Makuen and French both believe that if the tonsil must be removed it should be an intracapsular operation, leaving the capsule to line the fossa, or at least splitting the capsule and leaving one-half, for they believe the so-called capsule to be merely a portion of the interpharyngeal aponeurosis. The tonsil is considered a protection and not a menace in health, helping in both phonation and

articulation. The operation done by Makuen¹ is simple and briefly described. The tonsil is engaged and "picked up" with a dull Sluder guillotine and expressed from its fossa by the closure of the blade in the fenestra. A snare wire is then slipped over the tonsil, between the tonsil and the guillotine, and not over the guillotine itself. This is slowly tightened until the tonsil is severed from its attachment, taking with it a very thin membrane, the true capsule, and leaving the interpharyngeal aponeurosis intact. I have seen the results of this operation and believe them to be as he states, and I have seen tonsils enucleated by the usual methods that apparently took with them the aponeurosis; there were two or more layers of fibrous tissue attached to the capsule. It is a question in my mind whether the La Force instrument does not accomplish the same object and does it a little more easily.

Denman and McKesson² offer a contribution to the tonsil operation that is beginning to find favor in many clinics. This is the performance of the operation under *nitrous oxide-oxygen anesthesia*, with the patient in the forward-inclined sitting posture. This position is as old as the operation itself, and still has adherents; but the anesthetic is of comparatively recent origin. That it is a safe and pleasant anesthetic cannot be gainsaid. These operators also use morphine and hyoscine except in young children. The patient is strapped into the chair and the anesthetic administered through a nasal inhaler, fastened to the patient's head with elastic bands. The length of time in inducing narcosis is about two minutes.

G. P. Marquis³ in searching for *a way of avoiding infection of the sinus tonsillaris after tonsilleectomy*, with its attendant edema and soreness, finds that applications of alcohol and iodine accomplish this result to perfection and prevent the formation of the thick white exudate so commonly seen. It is, of course, necessary to control all hemorrhage, and this is done with a tampon soaked in alcohol, held firmly in place for a few minutes. The entire area of the fossa is then painted with a 25 per cent. solution of iodine, and it is said that there is almost no soreness next day. That this is a valuable method I firmly believe, and I have used it without the alcohol application with success. More lately, I have employed the formula of F. O. Lewis, of Philadelphia, composed as follows: Tincture of iodine, 1 dram; tincture of guaiac, 1 dram; compound tincture of benzoin, 1 ounce. This accomplishes the same result and is in itself also an astringent and a hemostatic.

A COMPLICATION OF TONSIL AND ADENOID OPERATIONS that has received scant attention, has been the occurrence of *lung abscess*. Morris Manges⁴ reports 9 such cases treated in one hospital in one

¹ Transactions of American Laryngological Society, 1915.

² American Journal of Surgery, May, 1915.

³ Annals of Otology, Rhinology, and Laryngology, December, 1915.

⁴ American Journal of Surgery, 1916, xxx, No. 3.

year, and quotes the experience of Yankauer who had seen 4 cases and Scudder who had seen several. It is suggested that this complication is caused by aspiration of blood or tonsillar tissue at the operation; or is due to embolism. He considers that this sequellum is avoidable if the patients are properly examined before operation, if the operation is carefully conducted so as to prevent aspiration of blood, and, finally, if the patients are kept in the hospital a sufficient length of time (2 or 3 days) to secure proper care and closure of the wound. He states that these abscesses never occur in private patients, which is a serious

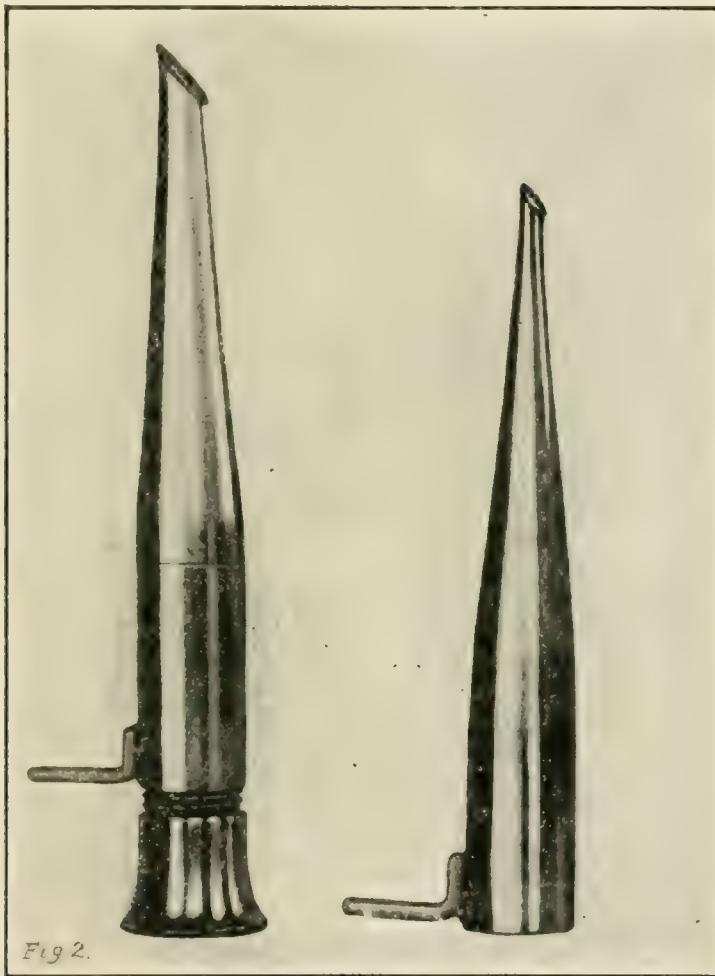


FIG. 18.—Tonsil microscopes with large and small apertures.

indictment. C. W. Richardson¹ also considers this question and attributes the infection to embolism, since the blood that might be aspirated is not infected blood and in the modern operation there are no small fragments of tissue. The septic material might readily be carried to the lung through the severed veins, which may remain patulous for several days. It seems to me that if this is the case, the postoperative care outlined by Marquis should minimize this danger. Richardson reports 5 cases that he has seen in a number of years and thinks that

¹ Laryngoscope, July, 1916.

there must be a great many more that are never reported, possibly because some of them develop so long after the operation that the connection is not suspected. While this may be so, it seems incredible that any great number could have escaped observation, and yet in conversation with many eminent operators I have failed to learn of such cases. In an active tonsil service at the Pennsylvania Hospital, where from 500 to 600 operations or more are done in a year, we have no such records during the past five years that I can trace. If this

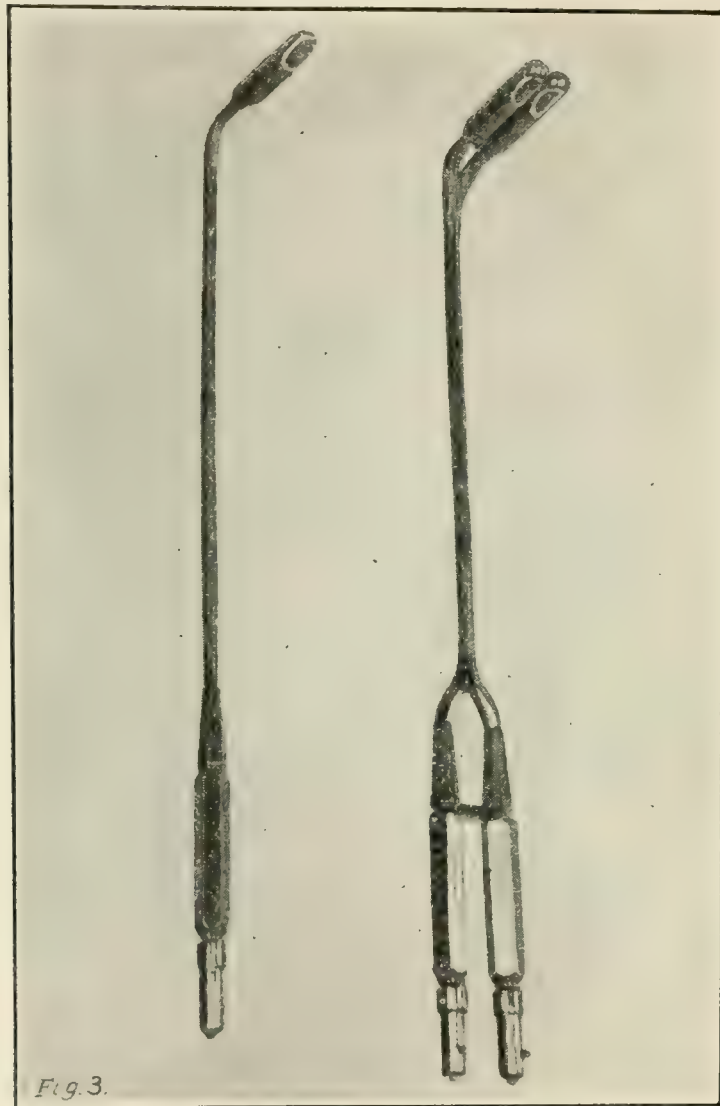


FIG. 19.—Single and double tonsil lamps.

complication is even nearly so prevalent as these authors think it may possibly be, we must surely agree with them in considering the tonsil operation, as now performed, decidedly a major operation, at least in its risk, as has often before been urged.

G. G. Coakley,¹ in discussing Manges's paper, entirely agrees with this view, and thinks that the complication is not due to the anesthesia,

¹ Laryngoscope, July, 1916.

which may produce pneumonia, but not pulmonary abscess. He considers embolism or infarction never responsible for a single abscess, but believes they are due to aspiration of the small, cheesy, bacteria-laden plugs, squeezed out during the very first stage of the operation, and that infection may be avoided by catching these on gauze sponges and removing them before there is any hemorrhage.

A complication following tonsil (or any other) operations under ether upon children, and one that is usually overlooked is *acidosis*, according to W. H. Johnson,¹ who mentions reports of several deaths from this cause, stating that during the past year there have been reported more deaths from acidosis following tonsil and adenoid operations than from any other. The symptoms of acidosis which develop after operation are dyspnea, nausea, and vomiting, usually cyclic or recurrent, headache, drowsiness or delirium, fever or subnormal temperature, and, if due to the acetone group, there will be the characteristic odor to the breath and the presence of these acids in the urine. The treatment is to empty the intestine with a warm enema of magnesium sulphate, glycerin and water, to be followed by colonic irrigation with a 5 per cent. solution of sodium bicarbonate, which may be repeated several times, or be given intravenously or subcutaneously. It is thought that the anesthetic plays an important part in producing this condition. I agree with the writer that we have all probably seen cases presenting these symptoms without recognizing their cause, and that we should endeavor to avoid this condition. This, Johnson states, may be accomplished, at least in part, by restricting the patient to a vegetable diet for several days before operation and by administering 15 grains of soda bicarbonate three times daily for the same period. If any tendency toward acidosis is found by blood or urine examination, an enema of 45 grains of soda one-half hour before operation is indicated. It is also of importance to prevent excessive muscular activity, emotional excitement, surgical shock, and excessive amount of anesthetics, as these tend to produce acidity of the blood.

That almost all cases of *septic arthritis* are caused by a focus of *infection* somewhere in the body is the belief of J. J. King,² who has made a special study of these cases. While it may be found in the ears, accessory sinuses, gastro-enteric tract, or the genito-urinary tract, it is most frequently located *in the mouth and the tonsils*. When the focus of infection is located in the tonsil, the treatment should be conducted by means of autogenous vaccines, and the removal of the tonsils delayed until all symptoms have subsided. The author has found, in many of these cases, a diplococcus differing in many particulars from those heretofore studied, which seems to be the causative factor in these painful joint conditions. This "*Connellan-King diplo-*

¹ Laryngoscope, August, 1916.

² New York Medical Journal, July 15, 1916.

*coccus*¹ is described as a small, bean-shaped, Gram-negative diplococcus, smaller than the gonococcus, which has never been found outside of the mouth and throat. Its best growing-media is human blood-agar with a little veal serum added, and it will not grow on more than 0.2 per cent. acid. It does not produce acid as do other Gram-negative diplococci, and it is not a gas producer. It grows best at a temperature of 39° or 40° C., and has a characteristic appearance on the media, the colony being dull yellowish brown with a rounded contour. It has been passed through rabbits and recovered from the heart's blood. The organism is not pyogenic, but a powerful toxin-producer, probably non-infectious for the blood stream; in other words, a local infection. It has never been recovered from aspirated joints or from the blood, or, in fact, any place except around the teeth and in the tonsils. When found in unsuspected tooth-root abscesses, there was no pain or toothache due to its non-production of gas.

In the *treatment* of these conditions the autogenous vaccine, 200,000,000, is administered three times a week until all activity of the infection has ceased, and then the tonsils, if the focus is there, are removed. The teeth also have most careful attention.

The author, from a study of several hundred cases where this organism was present, feels justified in concluding that:

1. The frequent presence of the Connellan-King diplococcus in the crypts of the tonsils or at the roots of the teeth in arthritic patients suggests that it may be specific, and that a simple tonsillitis may be followed by very serious complications, due to an absorption of chemical toxins.

2. The danger of a general sepsis following tonsillectomy might be eliminated if a culture were taken from each case.

3. When the focus of infection in arthritis exists in the tonsil, the treatment should consist in the injection of an autogenous vaccine until all infection is cleared up, and then the removal of the tonsils by enucleation.

4. The blood changes in the Connellan-King diplococcus infections seem to be a simple anemia, and, in a few cases, a slight increase in the eosinophiles, 4 to 6 per cent.

5. In some cases symptoms other than those for which treatment was instituted have disappeared. For instance, in one patient with arthritis and marked ethmoiditis the culture was obtained from the throat. Within two weeks after the institution of vaccine treatment, the ethmoiditis had cleared up while the arthritis was only slightly relieved. Another patient with serious gastric disturbance, who had found it necessary to remain on a strict diet, was able to eat almost everything after she had received treatment with the autogenous vaccine.

In the realm of operating, the six-year-old discussion in regard to

¹ J. J. King, Transactions of Section on Ear, Nose and Throat, American Medical Association, 1916.

the merits of the SLUDER OPERATION was renewed by Sluder¹ himself in a review of the subject and the points of the operation, which he declares is better performed as he originally outlined it with a dull, but not blunted, blade than with any of the modifications of his instrument. He freely confesses, at the end of the discussion of this paper, that it is not, as originally stated, "simple and easy of execution." On the contrary, there are many operators who can never use this method satisfactorily, just as there are others who can never use anything else. Each surgeon should adhere to that particular technic which he is best capable of doing. In Sluder's own hands, it is 99.6 per cent. efficient. In the discussion which followed the reading of this paper, Marquis felt that the operation is a difficult one. That it is the most rapid method nearly everyone will admit. He has seen a good deal of unnecessary trauma from the use of this guillotine, the hemorrhage has been greater than when other methods were used, and the finger must, as Sluder says, be educated to replace the use of the eye, which takes time and training.

Dixon reported almost bloodless tonsillectomies with the use of the LaForce modification, and I can say from personal experience that this is so. It takes a little more time but, in all but very small, submerged tonsils, a very pretty, dry enucleation is performed. But the operator must thoroughly learn the method and have practice before he can claim anything like 99.6 per cent. successes. E. L. Lewis has a modification of his own which he claims is entirely bloodless, and otherwise satisfactory. He uses an instrument carrying *two* snare wires, one of which acts as a hemostat by holding the puckered aponeurosis, while the other severs the attachment of the tonsil. Carter, in 2000 cases done with the original Sluder instrument, claims to work at the rate of 34 cases an hour, using four anesthetists! It does not seem possible that such rapidity can be good surgery—hemorrhage cannot be looked for or checked, hands washed, or gown changed. If we wish to call this a major operation, as we all do, we cannot countenance such rapid work even if each operation is well performed.

The Larynx. TUBERCULIN TREATMENT has not only proved of use in ozena, as commented upon above, but is being used successfully IN TUBERCULOSIS OF THE LARYNX by Hill Hastings.² Tuberculosis of the larynx is rarely primary and is usually a disease of long standing, giving the laryngologist ample opportunity to study directly the effects of any form of treatment. These secondary lesions of the upper respiratory tract frequently occur in patients who have been previously infected and who have acquired a certain degree of immunity, and therefore they often show a tendency to heal. This view of laryngeal

¹ Transactions of Section on Laryngology, Otology, and Rhinology, American Medical Association, 1916.

² Laryngoscope, May, 1916.

tuberculosis, while being the one usually held, is not accepted by R. F. Ridpath,¹ who claims that, by the use of the bronchoscope, the primary character of the laryngeal lesion can often be established. I have had occasion to point out the fallacy of this reasoning, for it is manifestly impossible by any bronchoscopic examination to detect small, active foci of tuberculosis deep within the lung tissue, to eliminate healed pulmonary lesions or even to inspect the bronchi of the superior lobes at all, much less to thoroughly examine the apices, where the disease usually first makes its presence known and is most prevalent. Hastings states that he has never, in an extended experience with this disease, seen a case of primary tuberculosis of the larynx, nor tuberculous laryngitis in a child. He has seen, however, in contraversion of the claims of Bandelier and Ropki, 2 cases of laryngeal disease develop in patients treated with tuberculin, although they ran a mild course. It is stated that there is a noticeable absence of catarrhal inflammation as a pretuberculous stage even in tuberculosis of the ear, the hoarseness, which usually precedes by a long time the actual soreness in swallowing, being usually due to the infiltration itself. The clinical location of the lesion in 99 cases reported is remarkably close to the autopsy findings of George Fetterolf,² in which the following *lesions in 100 cases dying of pulmonary tuberculosis* were tabulated: Involvement of the epiglottis in 59 cases, infiltration alone being most common, although closely followed by infiltration with superficial and deep ulceration, the former predominating. The ulcerations were usually found on the upper edge and laryngeal surface, these being the most exposed parts. The aryteno-epiglottidean folds showed gross evidence of tuberculosis in 58 cases, in which 57 were bilateral, infiltration alone or with ulceration being about equally divided. Edema was common in this location. The ventricular bands were involved in 48 cases, 38 being bilateral, the proportion between infiltration and ulceration being the same as before mentioned. The vocal cords were affected in 49 cases, bilaterally in 42, superficial ulceration being noted in 18, while the arytenoids were involved in 57, all bilaterally, infiltration being the most common type (44 cases) associated with edema in 12. In 49 cases the interarytenoid space was infiltrated in 47 cases.

That the clinical results of Hastings should so closely parallel these autopsy findings is remarkable, and shows the skill of the observer and how accurately a diagnosis may be made. He observed that pain was most often caused by deep infiltration of the arytenoids and interarytenoid folds.

In the tuberculin treatment of laryngeal tuberculosis much depends on the selection of cases, greatest success being obtained, as in any

¹ Transactions of Section on Laryngology, Otology, and Rhinology, American Medical Association, 1916.

² Laryngoscope, January, 1916.

other method of treatment, in those showing satisfactory lung conditions, and demonstrating a certain amount of resistance to the disease. The author believes in the efficiency of carefully regulated tuberculin treatment in selected cases of laryngeal tuberculosis.

Bronchoscopy. FOREIGN BODIES. The literature during the past year has been rich in papers dealing with endoscopic procedures, and one of great interest is contributed by Chevalier Jackson,¹ who has already given the profession so much of the greatest value. The appalling mortality of the beginner, he feels, calls urgently for some definite formulation of rules for safety, and this he has done, although, as he says, they are to be received tentatively. They are based on the assumption that, in uncomplicated foreign-body cases, mortality should not exceed 2 per cent. and that the introduction of the bronchoscope should not require longer than one minute, the remaining time being devoted to bronchoscopic search and a solution of the mechanical problems of foreign-body disimpaction and removal.

1. The anesthesia should be left to the choice of the operator, some preferring general, others local, and others none at all. In children, diagnostic, direct laryngoscopy should be done without anesthesia of any kind. This also holds good for an esophagoscopy in adults except when the ballooning method of Mosher is used, when general anesthesia is needed. Ether is preferable to chloroform. Cocaine and morphine are dangerous in young children.

2. A strict antiseptic technic should be carried out, for while it is absolutely impossible to sterilize the field, cleansing the teeth and mouth with diluted alcohol should be done in order not to introduce any other organisms than those already present.

3. The bronchoscopy should not be continued longer than twenty minutes in a child under five years of age, thirty minutes in one under twelve years of age, nor repeated at shorter intervals than five days in children under five years of age. In esophagoscopy, thirty minutes is the time limit under twelve years. In the newborn, the duration should not exceed fifteen minutes, except for the maintenance of respiration.

4. Four or more short bronchoscopies at intervals of a few days in an infant are very much less harmful than one long one. In adults, prolonged bronchoscopies have no special danger.

5. In foreign-body cases there are no absolute contra-indications. Aneurysm is a contra-indication to bronchoscopy for disease but not for foreign body.

6. In dyspneic cases, a tracheotomy is advisable unless the bronchoscopy can be done with speed. Following this, peroral bronchoscopy should be practised, as more freedom of movement is obtained and there is less danger of infection. It is, besides, a more familiar procedure, and the foreign body may be in the larynx.

¹ *Annals of Otology, Rhinology, and Laryngology*, June, 1916.

7. Primary requisite for safe bronchoscopy is gentleness.

8. No force should be exerted upon a foreign body until the particular mechanical problem has been studied and it is certain that it is free to be removed without trauma. The problem is not only to remove the foreign body but to remove it without serious danger to the patient.

9. It is dangerous to pull on a sharp-pointed object, such as a tack, until the point is in the tube mouth. In most cases of foreign body in the bronchi, the patient will live many months if no trauma is caused by attempts at removal, and therefore haste is not always advisable.

10. Full-curved hooks are dangerous, because they may catch inextricably in the branch bronchi.

11. Laceration and perforation of the esophagus is almost invariably fatal.

12. The motto of the bronchoscopist should be, "If I can do no good, I will at least do no harm."

That obscure lung symptoms in children or adults may be caused by aspirated foreign bodies which may have been forgotten, and of which no history is volunteered or obtainable, is becoming common knowledge to the profession at large, so that the wide-awake practitioner no longer makes his diagnosis in an obscure case without the aid of an *x-ray* examination, nor does he, at least to the same degree as formerly, assure his patient that there is nothing there, when there is a suspicious history, until a bronchoscopic examination has been made. The literature of such cases, when long-continued pulmonary symptoms were ultimately found to be due to a foreign body, is rapidly accumulating, and many cases of bronchiectasis, "empyema," or "tuberculosis" have been permanently cured by the discovery and removal of the offending *corps d'étranger*, as the French say. Chevalier Jackson,¹ to whom we are indebted for most of our knowledge of bronchoscopic procedures, reports a series of such cases in which foreign bodies had been unsuspected, or had been disregarded, and where they had remained in the bronchi for from a few days to nine and a half years. In the cases in which the intruder had remained for some time, he found stenosis of the bronchus, dilatation of the bronchus beyond the point of lodgment, and bronchiectatic cavities filled with pus and granulations.

From the histories of these and other cases reported by the author, the following conclusions are warranted:

1. Every case of bronchiectasis, chronic bronchitis, pulmonary tuberculosis, pulmonary abscess, and of chronic cough should have a radiograph taken regardless of how certain we may be of our diagnosis.

2. Every case in which the patient mentions the possibility of having aspirated, "swallowed," or "choked on" a foreign body should be studied radiographically, and if any symptoms of bronchial irritation

¹ Pennsylvania Medical Journal, August, 1916.

arise, the patient should be bronchoscoped anyway, even in case of a negative⁷ radiograph.

3. In all cases with a foreign-body history in which the foreign body is one not dense to the ray a radiograph should be made anyway and in most cases a bronchoscopy should be done also.

4. In case of any foreign body opaque to the rays having been "swallowed," the foreign body must be located with the rays or definitely proved not to be present in the body. Strange as it may seem today, patients are still told to "go home and forget about it."

5. A condition of "drowned lung," differing from pulmonary abscess in that the pus is contained in otherwise normal passages, may arise from the obstruction of a foreign body, and this condition may strongly simulate bronchiectasis. True bronchiectasis may follow if the foreign body is not removed.

The value of FLUOROSCOPIC BRONCHOSCOPY in removing foreign bodies in the lung is brought to the front by E. Fletcher Ingals,¹ who reports a number of cases so treated by himself and others. He does not believe that this method makes the endoscopic removal of these objects so easy that untrained men may safely operate, but says it is a great help to the trained bronchoscopist in certain refractory cases. It is indicated in all cases in which the foreign body casts a shadow with the x-rays when the ordinary method has failed, and especially in the following classes:

1. When there is so much mucus, pus, or blood that it is very difficult, or impossible, to see the foreign body.
2. When granulation tissue covers the foreign body.
3. When a stricture has formed proximally to the foreign body.
4. When the foreign body is hidden in an abscess cavity.
5. Difficult cases, in which the foreign body is lodged in an upper lobe bronchus, or when it cannot be exposed by the ordinary methods.

An anesthetic is usually not required, but a good radiographer is, and it is well to remark that the method is not without some danger to the radiographer from prolonged exposure to the rays.

The technic is to place the patient on a special table with the x-ray tube beneath. Lynch² has successfully used a cot constructed of two clothes-poles joined with canvas, which has the advantage that it can be easily extemporized, and that the patient can be turned so as to see the foreign body and forceps at different angles. The bronchoscope is introduced in the usual manner and the surgeon stands at the patient's left, directing the bronchoscope by the shadow on the screen to as near the foreign body as possible. Forceps are now passed and, still guided by the shadow, manipulated into the same bronchus that contains the foreign body. It can be ascertained that this has been

¹ Transactions of American Laryngological Society, 1915.

² Ibid.

accomplished by moving the forceps backward and forward. The object is then seized and withdrawn. Care must be taken not to grasp lung tissue, or, if this has happened, not to exert force. It is not hard to tell when the body itself is in the jaws of the forceps, as they can be seen to be only partially closed. Ingals suggests that one hour should be the limit of search by this method and that the *x*-rays should be interrupted every few minutes for greater safety.

The causes of failure to remove foreign bodies have been carefully studied, and recently some of them eliminated. Thus Jackson formerly considered one such cause the inability to find a small foreign body when lodged far out toward the periphery of the lung in a bronchus too small for a tube to enter. It is reasonable to suppose that fluoroscopic bronchoscopy might reach many of these cases, since the long, slim forceps can pass where the smallest tube cannot. Bodies lodged in an upper lobe bronchus have offered almost insuperable difficulties, although fortunately these bronchi are rarely invaded, due to their position. In Jackson's Clinic this happened only 4 times in 482 cases. The difficulty here is that a view of the object cannot be obtained, as it is "around the corner." Jackson was able to expose these bodies by displacing the spur or "corner" by lateral pressure with the tube-mouth, the head and neck of the patient being pressed far over and down toward the opposite shoulder. For objects that cannot be reached by this method, the author has devised forceps, the tip of which, when opened, reaches "around the corner" and may be made to grasp the foreign body. As it cannot be seen, great care should be used, and the object be brought down only to the point where it can be clearly seen, when the ordinary straight forceps completes the delivery.

The value of Killian's method of SUSPENSION LARYNGOSCOPY is gradually becoming more apparent, especially since the limitations of the original technic have been very materially lessened by the work of R. C. Lynch,¹ who has modified and perfected the instruments. The difficulties most of us had with the original apparatus were in exposing the anterior commissure, in keeping the tongue-spatula in the middle line so that the tongue did not slip off to one side, to keep the tongue from folding around the spatula when it was in the median line, and to keep the epiglottis retractor in position and the epiglottis out of the way. Lynch has remedied these defects by constructing a triangular mouth-piece with dental plates so that the head is held immovable and the strain put upon all the teeth instead of upon two, as with Killian's instrument. Furthermore, the spatula is made much heavier and more rigid, and of such construction that it will hold the tongue steady and without curling, and also the epiglottis, without the aid of the special retractor. The instruments are all blackened,

¹ Laryngoscope, December, 1915.

to avoid light absorption, and the table elongated at the side to allow more room for the traveling crane. With the use of this instrument the operator can sit looking directly into the larynx, with both hands free to do any necessary surgery, and it has been used for every endolaryngeal surgical condition with ease and success. Lynch advises strongly against everyone taking up this branch of surgery, as it needs constant practice and skill to avoid danger, and an absolute requisite is a good apparatus strong enough to meet every emergency. The chief advantage of this method, as said before, is that the operator has both hands, and can take his own time for the work. With good illumination, which is easily obtained, and with no part of the instrument obscuring the operating field, the view is limited only by the walls of the cavities under examination. The entire oral cavity can be seen, as well as the mesopharyngeal and hypopharyngeal spaces, mouth of the esophagus, and the posterior and interior aspects of the larynx and trachea. A view can also be obtained of the interior of the ventricles and the inferior surfaces of the vocal cords, either with the tilting mirror, designed by Lynch, or by using retractors.

The surgery of the larynx under suspension is carried out, with slight modifications, just as surgery in any other part of the body. Dissection, suturing, and plastic work can be carried on as well as in the vagina for instance; the bronchoscope or esophagoscope easily passed by this method, foreign bodies in the larynx or trachea removed with forceps without the use of the tube, ulcerated areas cauterized accurately, etc.

The suspension method is applicable only to hospital practice—not to office or emergency work. It cannot be used satisfactorily when the cervical vertebræ are fixed, or the mouth cannot be opened wide. A large tumor at the base of the tongue likewise contra-indicates its use.

Deafness. SUGGESTIONS FOR THE TREATMENT OF CATARRHAL DEAFNESS are always welcome, for no matter how much good we may be able to do to many of our cases, there are always the disappointing ones in which improvement comes to a stand-still after all the measures at our command have been tried. W. E. Dixon¹ believes that catarrhal deafness can most certainly be prevented, and can be checked at almost any stage of its career. His technic calls for the use of stiff metal applicators and bougies, with the distal end curved or bent at an angle of 45 degrees.

There should be a number of these, with the bend at various distances, ranging from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches from the tip. The application of a medicament to the Eustachian tube is accomplished with a nasopharyngoscope in the opposite nostril and the applicator passed

¹ Laryngoscope, June, 1916.

along the floor of the nose on the side to be treated. It is to be noted that no catheter is used and that the applicator is stiff, with a permanent bend. The operator, taking advantage of the anatomical fact that the orifice of the tube extends in a vertical direction 8 to 12 mm., that the floor and lower four-fifths of the outer wall of the tube are fibrous and elastic, and that the anterior part of the tube is funnel-shaped in the vertical diameter, now turns the point of his applicator to the floor of the tube-mouth and rotates it outward, upward, and

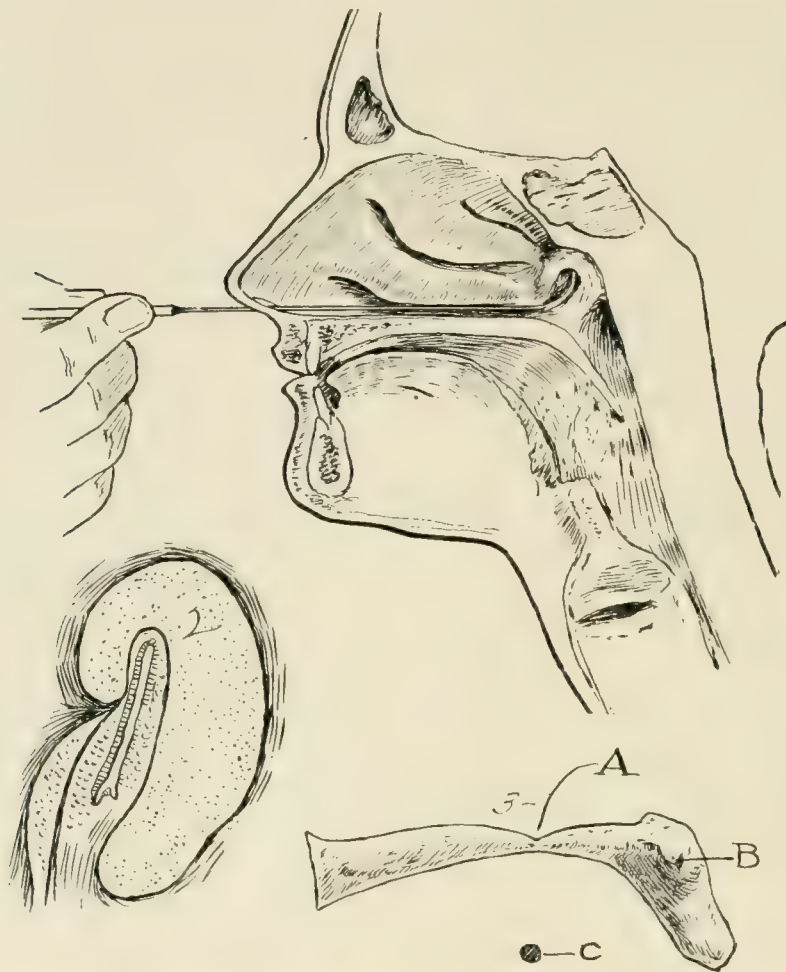


FIG. 20.—1, applicator introduced; 2, pharyngeal end of tube; 3, cast of tube, tympanum and external auditory canal.

backward, all the time keeping the instrument after its rotation in the upper part of the tube, or between the anterior and posterior plates of the upper portion.

A cocain and adrenalin mixture is carried up to deplete the tubal mucosa, and the first applicator usually stops short of the isthmus, a longer one being next introduced. Naturally, the greatest obstruction is usually found near the isthmus, and force must not be used to overcome this resistance, only slight, continuous pressure being needed in most cases. After the whole tube has been depleted, a 1 or 2 per cent. solution of silver nitrate, or sometimes argyrol, is applied, at first on

alternate days and later on with a lengthening of the time interval between treatments. This treatment appeals to me, for I have seen some really startling results at times from making applications the entire length of the tube, but personally have always used Yankauer's flexible applicators and bougies through a catheter. When I first heard the author of this method describe it, I could not see how a stiff applicator could be introduced through the isthmus, but his description of the anatomical reasons makes it seem plausible. There is no doubt in my mind as to the value of the procedure, especially when coupled with Dixon's other methods. Naturally, the greatest degree of success is

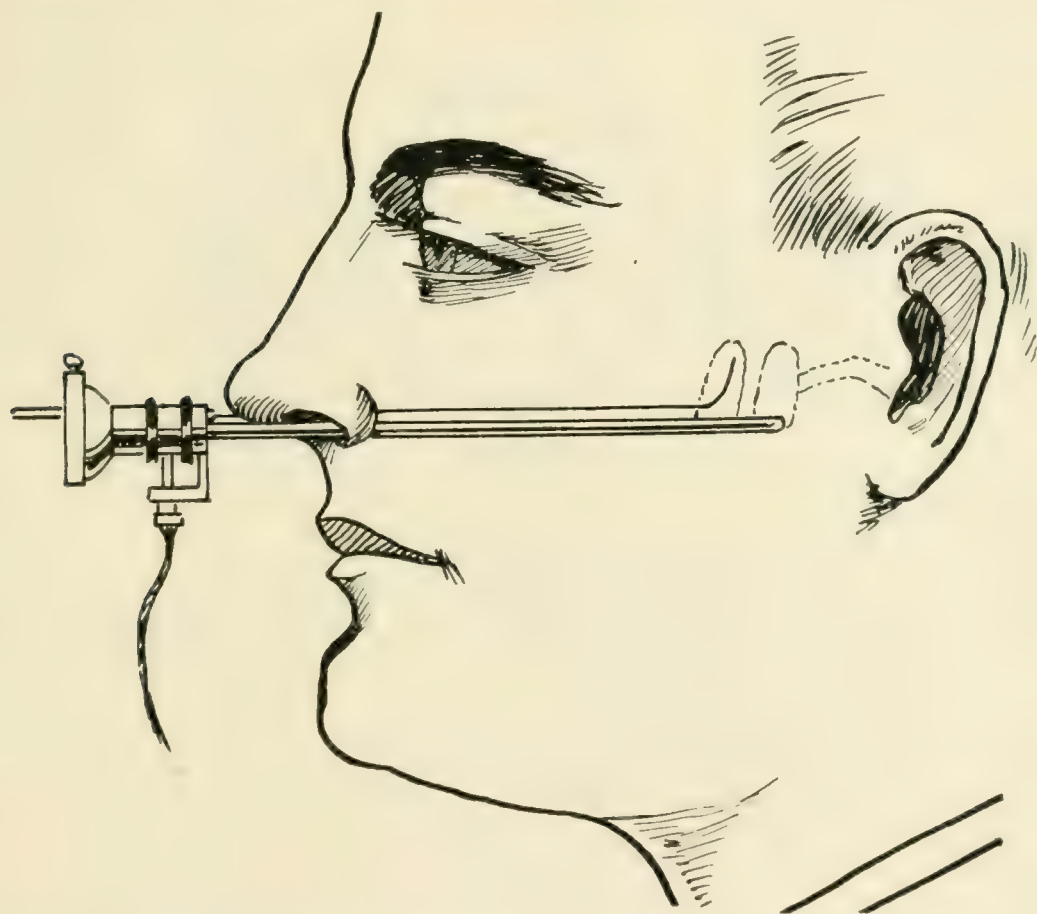


FIG. 21.—To illustrate method of treatment.

obtained in those cases of catarrhal deafness with stenosed tubes, but even in those cases in which the tubes are patulous, improvement may be expected to follow active medication of their mucosa.

Dixon makes a great point of entirely clearing up the nose and nasopharynx before any tubal medication is attempted. He finds that 75 per cent. of people of all ages have adenoid growths, and it is almost impossible to discover healthy tonsils in an adult. Consequently, he, with the greatest care, removes all of these, paying, of course, particular attention to Rosenmüller's fossæ. It is in this position that adhesive bands form, causing the deafness that the osteopaths some-

times cure by breaking them up. Care should be used in searching for cases of latent ethmoiditis or sphenoiditis, and their correction, when found; spurs and ridges cut away from the septum, and, in fact, every abnormal condition corrected. By this time the deafness may be cured without further treatment of the tube or ear.

The treatment of the tube, as outlined above, is continued, at longer intervals, even after the tube remains open. Inflation is seldom used. Many cases on whom it had been used with massage, unsuccessfully, responded quickly to the tube applications. This method, at the worst, gives us one more string to our bow, and should possibly be easier and more successful than Yankauer's methods, which otherwise it closely resembles.

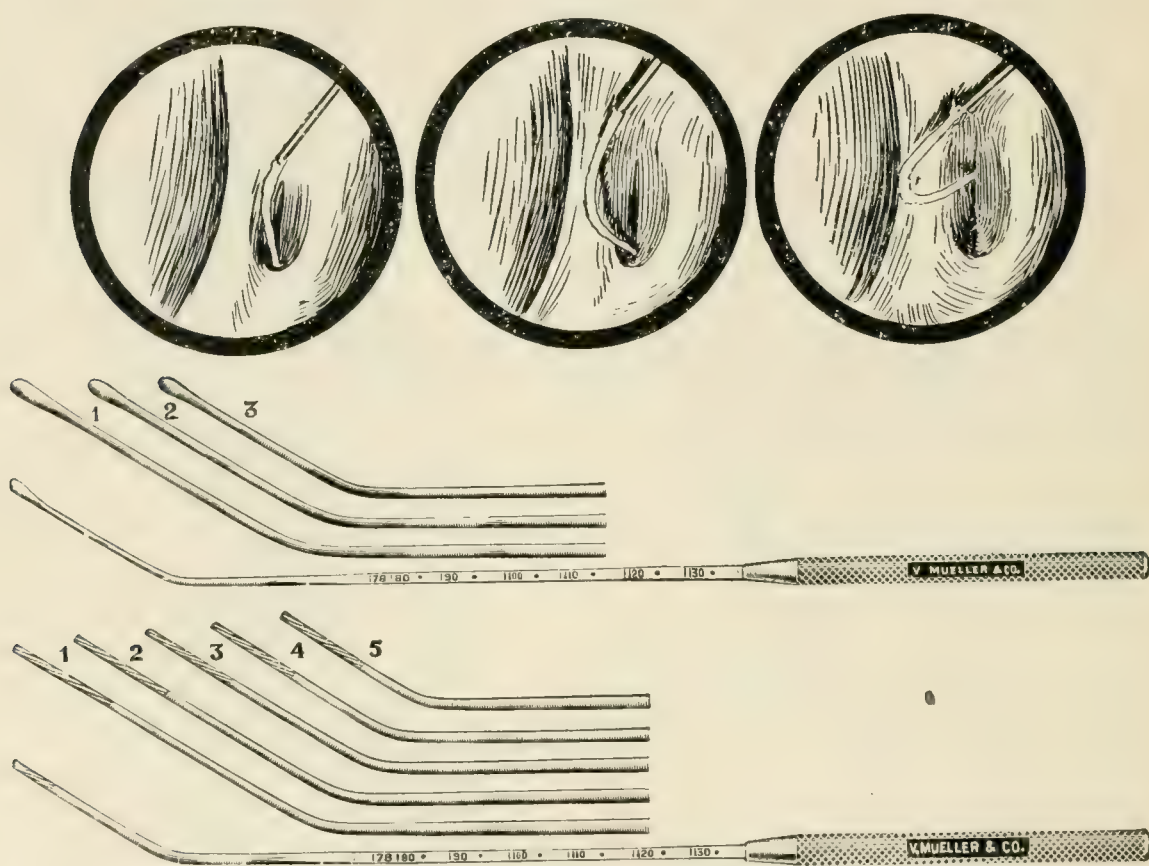


FIG. 22.—Eustachian applicators.

Pursuing the study of WAR DEAFNESS FROM LESIONS OF THE INTERNAL EAR,¹ which was prompted by the number of cases that came under his observation as a result of the early battles of the war in Europe, A. Got² has brought to light some interesting observations from the more recent cases. In the previous report there were 100 of these cases, all of which showed cochlear hypo-excitability, while out of 17 cases deaf from the explosion of shells, bombs, grenades, etc., 4 were hyper-

¹ Gazette hebdomadaire des sciences medicales, July, 1915.

² Revue de laryngologie, d'otologie et de rhinologie, January, 1916.

excitable in regard to the vestibular reactions, 11 were hypo-excitable, none were unexcitable, and 2 were normal. Of 13 deaf as the result of direct wounds of the head, 5 were hyperexcitable, 4 hypo-excitable, 2 unexcitable, and 2 were normal. Of these 32 cases there are, therefore, two groups: One in which the injury was from the result of explosions, with the air as an intermediary, and the other resulting from direct injury to the head. In all cases the ear symptoms were caused in part by hemorrhage, which seemed less severe in the former; but concussion of the organ of Corti, with, or without, destruction of the membrane, probably also played a large part. Most of these cases improved fairly rapidly, even with regard to the hearing, but there were no complete cures except in those of psychic origin. Of those showing vestibular symptoms, the vertigo and nystagmus were the first to disappear, as would be expected, and equilibrium more gradually became normal. The cochlear function was the last to respond.

In the study of the more recent series of cases it is found that, in the great majority, the labyrinthine injury is caused by the bursting of a shell in the immediate vicinity of the patient, usually between 2 and 5 meters, and that beyond that distance the ear resists the effect of the concussion or the disturbance is slight and will rapidly disappear. It seems incredible that this extremely short distance from an exploding shell would not take the life of the subject, but I have been compelled to depend upon the translation of this article by Macleod Yearsley,¹ since the issue of the *Revue Hebdomadaire* containing the original has apparently not reached America, although all other numbers have arrived with great regularity. Patients suffering from this form of concussion deafness are unequally affected, depending upon the distance from the exploding shell and its position in regard to the patient, whether on one side, in front, or behind. In those cases caused by direct injury to the bone, the nearer the wound to the petrous the more serious is the lesion of the internal ear, other things being equal. Got modifies his previously expressed opinion that the "wind deafness" cases were less serious than those due to direct injury; he has found serious head wounds without labyrinthine involvement, and very serious disturbances caused by the "shell wind."

As to the question of previous ear troubles, it must be remembered that statistics are not reliable here for the reason that most of those with defective ears have not been exposed to the active conflict of the trenches. At any rate, there seems to be a fair percentage that show some middle-ear involvement. The opinion expressed by Lermoyez² that the patients starting with healthy ears are more often injured in the labyrinth than those with defective ears at the start seems to be confirmed. The statistics in 283 cases show 77.02 per cent. without

¹ Journal of Laryngology, Rhinology, and Otology, September, 1916.

² Presse Médicale, February 25, 1915.

antecedent middle-ear involvement against 22.96 with middle-ear lesions.

In the less severe cases the etiological factor is solely a question of concussion, due to shock produced by the sudden displacement of the extralabyrinthine and intralabyrinthine fluids; while in the more serious forms it seems probable that the pathological condition is hemorrhage accompanied by detachment and disintegration of the organ of Corti. This is confirmed by the analogous lesions in the eye where they can be readily observed, and the very close similarity exhibited by these cases to Ménière's disease.

Deafness is the predominant symptom, and is always of the labyrinthine type, showing abolition of cranial perception for the watch, some diminution of air conduction, loss of perception for high tones, Weber lateralized to the better ear and Rinne positive. Tinnitus is always very marked and constant. The deafness often diminishes in the course of some weeks, but may persist without modification for months, and is probably permanent in some cases. It has never been seen to increase. Vertigo is marked but usually diminishes rapidly, as does also the spontaneous nystagmus, a symptom which is necessary to establish the diagnosis of "traumatic labyrinthitis." In most cases it is directed to the side least affected, unless there is complete destruction of the labyrinth, in which case it is reversed.

The question of DIAGNOSIS is a very interesting one since it is complicated by the possible inclusion at times of HYSTERICIS AND MALINGERERS, although the latter have been few in number. It is not, as a rule, difficult to separate the organic from the functional cases (hysterics and malingerers), but it is often extremely hard to differentiate between the latter two. Owing to the scant lack of practice in detecting malingerers in civil practice, I think it may not be out of place to give the views of this eminent authority backed by the experience of Prof. Moure. The latter lays stress upon the fact that, in the functional group, the deafness is absolute, "too absolute to be real," and is almost always bilateral. If unilateral deafness is claimed, the falsity of the claim is easily detected by the use of the noise producer or the double stethoscopic tube well handled. No matter what the intensity of the sound may be, malingerers and hysterics will deny any trace of hearing which must always be regarded as a suspicious circumstance. Unless the subject has been educated by a passage through other hospitals, there are neither tinnitus, vertigo, nystagmus (though this could scarcely be simulated), nor disturbances of equilibrium. Most important is the fact that the timbre and tone of voice in these two classes remain normal, which implies that, knowingly or not, they can hear themselves speak.

In order to separate hysterics from malingerers, Prof. Moure says that, after all is said and done, we must depend upon catching the

subject *in flagrante delicto* of fraud, which is more psychological than medical. With the noise producer the hysteric will sometimes preserve the tone of his voice, as in organic disease; the unwarned malingerer will always raise it. The malingerer has a pose of detachment from the things of the world, while the hysteric seeks to attract attention, and will besides show zones of cutaneous anesthesia, a reduction of the visual field and abolition of the pharyngeal reflex. In these cases, immediately a diagnosis is made, the patient is transferred to the neuropsychiatric service. It is of the utmost importance to get these cases out of a general hospital where they may be educated into presenting the graver symptoms of ear disease, and may thus become incurable.

The *prognosis* for the organic cases is that the simple disturbances are cured in a few weeks; the others *get better slowly or stop* as they are. The tinnitus often remains unchanged and is probably definite. The vestibular phenomena disappear or diminish first, the disturbances of induced nystagmus (hypo-excitability) remaining for a long time.

The *treatment* is simple enough: Absolute rest for the body and ear as well, excluding, of course, tympanic inflation or massage. Bromides and iodides are administered; counter-irritation over the mastoid, lumbar puncture in severe vertigo, and a light diet is the routine followed.

Syphilis. Since the introduction of salvarsan in the treatment of syphilis, the attention of otologists has been directed to the apparent increase in the number of cases showing signs of SYPHILIS OF THE EIGHTH NERVE, although such cases were well-recognized previous to that time, and the question has been argued back and forth as to whether the labyrinthine symptoms, both acoustic and vestibular, were caused by the toxins of the spirochete or the toxic effect of the arsenic in the therapeutic preparation administered. George E. Davis¹ reviews the field carefully, and furthermore believes that the reactions of syphilis are manifested very early in the cochlear branch of the eighth nerve and may easily be determined by careful functional tests.

Even before a positive Wassermann reaction can be obtained, namely, in a month or six weeks following infection, an early diagnosis of syphilis may be made by the otologist. The principal finding depended upon is a strongly positive Rin   test, with air conduction unimpaired, particularly for low tones, but with bone conduction materially reduced or even lost altogether, unless there is present a coincident middle-ear lesion. So constant is this finding that it can be considered almost pathognomonic of lues in the primary or secondary stages, and may be often found in hereditary syphilis. Willcut is quoted as reporting the ear findings in a series of 300 cases in the Urbantschitsch Clinic where

¹ Laryngoscope, August, 1916.

58 cases were of a month's duration or less. Fifty-two of these latter showed a definite shortening of bone conduction with the exclusion of all other conditions that might have caused it. If an acute middle-ear inflammation should intervene, the lowered bone conduction is temporarily raised, although never above normal, only to become reduced again with the subsidence of the acute otitis media.

There are two theories advanced for this symptom found in about 90 per cent. of cases: O. Beck¹ attributes it to an increase in intracranial pressure and finds that after lumbar puncture, there is a transitory increase in bone conduction with the decrease of the cerebrospinal pressure. This theory seems to be supported by the well-known results of the Gelle test, where the pressure, although in this instance it comes from the outside, reduces bone conduction. Davis finds that the application of the Gelle test to these cases will still further shorten bone conduction, provided there is no fixation of the stapes. Willcut, Knick and Zaloziecki,² on the other hand, believe this symptom to be due to the action of the toxins on the eighth nerve, having found this reduction of bone conduction in cases too early for the development of a meningitis of sufficient extent to produce increased cerebrospinal pressure. Their theory is that the toxins and endotoxins of the spirochete circulating in the blood effect primarily the most sensitive tissues, including under this head the cranial nerves.

These functional hearing tests are, therefore, to be regarded as strongly diagnostic of early syphilis:

1. Bone conduction definitely shortened.
2. Rinne positive.
3. Air conduction: Low notes relatively normal, high notes definitely lowered.
4. Bilateral affection.

With the advance of the disease there is often a sudden augmentation of the aural lesions, by the involvement of the vestibular branch. The auditory branch involvement, usually the first, gives a quite constant, severe tinnitus, soon followed by impairment of hearing, while invasion of the vestibular nerve fibers produces static disturbances; vertigo, nausea, vomiting, disturbed equilibrium, prostration, etc. There are important diagnostic signs to distinguish between specific neuritis and inflammatory, or suppurative, labyrinthitis. In the former we find marked variations from day to day in both the acoustic and static disturbances, and a severe attack is often preceded by several milder ones; while in inflammatory labyrinthitis the first attack is the most severe, and the symptoms, with coincident acoustic and static disturbances, either remain permanently or gradually ameliorate. The difference in time between the involvement of the acoustic

¹ *Annals of Otology, Rhinology, and Laryngology*, 1913, xxii.

² *Berl. klin. Wchnschr.*, 1912, Nos. 14-15.

and vestibular branches in lues is attributed to the greater vulnerability of the former to the luetic toxin.

There seems to be an increase in the number of such focal reactions, or "neurorecidives," since the introduction of salvarsan, and the question as to their causation must be regarded as being still a mooted one. The claims that they are due to the toxic action of the salvarsan, or to the provocative effect on the entrenched spirochetes, with liberation of large quantities of endotoxin, are urged by different writers. However, clinical experience seems to show that salvarsan, properly and persistently administered, plays an important part in clearing up such focal lesions. Ehrlich believed that the spirochetes in the general circulation were easily destroyed by the drug, but that those in nerves escaped, owing to the restricted vascularity of these organs, and that the spirochetes focussed in these points multiply rapidly, cause infiltration and swelling of the nerves, which, if confined in narrow, bony canals, as the eighth, are subject to counter-pressure and loss of function. This would explain why repeated doses might relieve the symptoms enumerated above. Davis believes that the occurrence of an eighth nerve neuritis is not an indictment of the remedy but of the technic of administration. Either the dose has not been sufficiently large, or not repeated sufficiently often and continued long enough to completely destroy all the *Spirochete pallida* in these avascular foci. The safety and efficiency of salvarsan administration depends upon its timely and intelligent use, controlled by repeated examinations of the blood and cerebrospinal fluid.

Otitis Media. For better DRAINAGE OF ACUTE SUPPURATIVE OTITIS MEDIA, Jno. Guttman¹ suggests a new procedure that has worked satisfactorily in his hands, although it may not appeal to the average aural surgeon. He calls attention to the well-known fact that many ear drums, after being opened, heal too rapidly, a condition for which Robert Lewis recommended, in 1912, the use of a punch to remove a small portion of the tympanic membrane. Guttman condemns the usual slit-like incision, which easily clogs up with coagulated blood or viscid secretion. He uses, instead, a specially devised trephine, consisting of a hollow steel barrel, 8 cms. long, at the lower end of which is a very sharp circular knife, 2 cms. in diameter. It is always used in the lower posterior quadrant of the drum irrespective of the location of the bulging. Two or three turns of the trephine will cut a clean hole in the drum, leaving the cut-out piece in the trephine. Very free drainage is at once established, but the perforation is not a permanent one and will always heal as soon as the suppurative process stops. Guttman does this operation under local anesthesia preferably, injecting a few drops of cocain in the upper wall of the canal, although

¹ Annals of Otology, Rhinology, and Laryngology, June, 1916.

general anesthesia is used at times. It is also used in chronic cases with insufficient drainage.

When, in 1910, Yankauer introduced the CLOSURE BY CURETTAGE OF THE EUSTACHIAN TUBE FOR THE CURE OF CHRONIC SUPPURATIVE OTITIS MEDIA, it was hailed by many as a possible alternative to the radical mastoid operation in a certain class of selected cases. Naturally, much criticism of the method developed among those who failed to secure the encouraging results reported by the author of the method, and, in defense of his position, Yankauer¹ reviews his results to date and gives the consensus of opinion as expressed in a question sent out by him to the majority of aurists in this country. In the replies received from 119 operators, reporting on 735 operations, it was stated that the tube had been closed successfully, after one or more attempts, in 609, or 83 per cent., of the cases. The number of patients reported cured was 379, 51 per cent. of the total number, or 62 per cent. of those in which the tube had been successfully closed. In other words, more than one-half of all cases of chronic middle-ear suppuration were cured by closure of the Eustachian tube through the external auditory meatus without any other surgical treatment. The reports on hearing in 564 cases were also of interest, 258, or 46 per cent., showing improvement; 281, or 50 per cent., being unimproved; and 25, or 4 per cent., being made worse. As the total percentage of cases cured was 57 and the hearing was improved in 46 per cent., it is apparent that in the cured cases improvement of hearing took place in 90 per cent.—a very remarkable record, when contrasted with hearing tests after the radical operation. Improvement in the tinnitus was also noted in a large number of cases. The results may be summed up with the statement that half of the cases are cured with an improvement of hearing and a diminution of the tinnitus, and that in the cases that were not cured, half of them had the suppuration lessened.

The operation is based upon the principle that the closure of the Eustachian tube is essential to the healing of a suppurating ear, by preventing reinfection from the nasopharynx. T. J. Harris objects to this method for the reason that an important part of the mechanism of hearing is destroyed, while its function of ventilation and drainage should be preserved. Yankauer's answer to this objection takes the ground that the middle ear needs no ventilation through the tube as long as there is a permanent opening in the drum membrane, and that this will never close if the lumen of the tube has been obliterated; that with this perforation the drum does not transmit sound waves, and that it is necessary to close the tube at the time of the radical operation in any case. As for the function of drainage, it is so insufficient in a suppurating ear, at best it can play but a small part;

¹ Transactions of American Laryngolog., Rhinolog. and Otolog. Society, 1916.

while if the tube becomes permanently closed and the middle ear dry, there is no longer any need for a drainage tube. On the other hand, with an intact drum membrane it is impossible to force solution through the tube from the nasopharynx to the middle ear, the contained air acting as a barrier; while if the drum is perforated, this air cushion no longer exists, and infection may, and is, blown through the ear, keeping up the suppurative process in the middle ear.

From his personal experience and the results of the investigation quoted above, Yankauer states as a dictum that whenever the Eustachian tube is permanently closed by organic atresia, a perforation of the drum membrane will never close and cannot be made to close. Therefore, whenever it seems possible to cure the discharge with closure of the perforation, the tube must not be curetted. It should, therefore, never be done for acute exacerbations, or in subacute cases, being reserved entirely for those chronic suppurations which have resisted other methods of treatment. Of course, it is contra-indicated in the presence of labyrinthine and intracranial complications on account of the element of time, the one death reported being due to meningitis following a curettage of the tube fourteen days before.

No matter what method is used to cure a middle-ear suppuration, the author believes that, when cured, reinfection must be prevented, which is what he aims to accomplish by his operation, and which seems entirely reasonable. He furthermore believes:

1. That closure of the Eustachian tube is harmless because it does not cause the loss of any function which has not already been permanently destroyed.

2. That it is a valuable therapeutic agent because by it alone half of the cases are cured and the rest so improved that it enables the radical operation to cure the other half.

3. That it is imperative, not only because the tube has assumed a perverted or pathological function, but because the only other resource which is open to the patient is a radical operation, in which case the tube must be closed anyway.

4. That every patient should be given the benefit of this procedure, not only because the chances of cure are sufficiently high, but also because, if cured thereby, the hearing will not only be preserved but improved.

5. That the radical operation should be regarded as unjustifiable in any cases where there is useful hearing left, until a thorough trial has been given to the closure of the tube alone through the intact auditory passages.

Personally, I believe this procedure to be of value in preventing reinfection although I, in common with others, have experienced great difficulty in obtaining a tubal closure that would be permanent. Whether or not it will cure the suppuration would depend in part on

the amount of destruction in the middle ear, caries of the ossicles, retention pockets, etc. These same objections apply with equal force to the VACCINE TREATMENT OF CHRONIC AURAL SUPPURATIONS, which has accomplished results in many different hands and without surgery, very closely comparable to Yankauer's statistics. The ideal method, it seems to me, is a combination of all these three: Tympanic surgery to remove diseased tissue incapable of regeneration, and to drain foci of infection; vaccine therapy to raise the resistance of the patient and stimulate the production of an active immunity; and the closure of the Eustachian tube to prevent reinfections. When this method is carefully followed out, I believe very few cases, except those exhibiting cholesteatomata would come to a radical operation. It has been my experience with vaccines that about 50 per cent. can be made dry by their intelligent use without surgery of any kind, and I believe the percentage could be greatly increased as mentioned above. The difficulty with vaccine treatment, if we accept the theory of specificity so strenuously insisted upon by the Wright school but now being subject to severe attacks in the discoveries of Jobling, Peterson, Kraus, Ichikawa, Lüdke and Gay, is the difficulty of obtaining potent, specific vaccines. M. S. Ersner and I¹ obtained dry ears in 46 per cent. in a series of 50 cases, making our own vaccines and conducting the entire treatment ourselves, and without any treatment other than vaccines. Although convinced of the potency of stock vaccines of the same type as the organism causing the infection, we nevertheless endeavored in this series to obtain the causative organism from each individual patient and prepare an autogenous vaccine. The difficulties in the way of an otologist doing this work are great, and yet it is our belief that it must be done in this way to obtain the best results, since division of the work between laboratory and clinic will result in some unnecessary failures. If the specific method of vaccine preparation for these cases of running ears, where there is almost always a mixed infection, is to be successful in the future, there must, it seems to us, be some way found for determining the causative organism. This we attempted to do by complement-fixation tests but without result, possibly through not having developed a delicate enough technic, and possibly because the strains of organisms used as antigens were not numerous or varied enough. The value of stock vaccines, in which we already believed, was emphasized by the fact that at one time there were 5 cases under treatment with autogenous staphylococcic vaccine. Only one of these became dry, so while awaiting the preparation of fresh vaccine for the other four, they were given the surplus from number one, the dry case, and all became dry after a very few doses.

It may be out of place to lay much stress on specific vaccine therapy

¹ Pennsylvania Medical Journal, May, 1916.

when it is possible that it will all be thrown into the discard soon, but, pending these developments, as it is the best method at our disposal, however imperfect, some comment may not be out of place. The newer form of vaccine therapy for general diseases calls for intravenous administration of large doses of vaccine, with resulting severe general reactions, and it may be possible that we have been proceeding too cautiously in our ear work, even endeavoring to avoid general reaction. In one of our most successful cases, one of long duration and cured by one dose, the reaction was excessive, due to the fact that a live culture was injected. While this giving of a live vaccine has been advocated, in our case it was not done intentionally, and, in justice to ourselves, it was not one of our own preparation. It raises the question, however, whether large doses with resultant reaction, or injection of living bacilli, either subcutaneously or intravenously, as done by Friel, would not go far toward solving some of our present difficulties.

Since the newer ideas in immunology have necessarily been mentioned, some reference, although brief, may be made to them here, although they do not pertain to the ear more than to infections in any part of the body. These NON-SPECIFIC FACTORS IN THE TREATMENT OF DISEASE are clearly set forth by Jobling and Peterson¹ who state that medical consciousness has centered largely around ideas of specificity by biochemical products, taking its cue from the laboratory as a natural consequence of the phenomenal advance made in this direction in recent years. And yet one finds a not inconsiderable undercurrent of evidence, from both the laboratory and the clinic, calling attention to other and non-specific factors which have been neglected until recently. It was early shown by Matthes that in tuberculin therapy the reaction usually regarded as specific could be produced by deutero-albumose. In typhoid fever the same thing has occurred, where Rampf employed vaccines of *Bacillus pyocyaneus* to obtain the same results and reactions as when *Bacillus typhosus* was employed, and Schmidt has called attention to the fact that, following vaccine therapy of any kind, the body becomes resistant to a variety of infections. While vaccines were administered subcutaneously for the cure of typhoid fever, the results were, on the whole, encouraging, but, with the employment of the intravenous method, a very startling abortion of the disease followed, preceded by severe general reactions. Kraus, Ichikawa, Lüdke, and others, discovered at this time that vaccines made with other organisms, and even a non-bacterial split protein—deutero-albumose—gave the same results, and on the other hand, that the typhoid vaccine, so administered, would cure other diseases than typhoid fever. In view of these facts and others too intricate to detail at this time, it would seem possible that these with various

¹ Journal of American Medical Association, June 3, 1916.

agents act as stimulants of the hematopoietic tissue, which, as a consequence, suddenly floods the body with antibodies, thereby overcoming the infection, and that the hematopoietic system is attuned to respond to a non-specific stimulus with the production of specific substances, a selective stimulation. Miller and Lusk,¹ following the work alluded to above, treated first typhoid fever and then acute and chronic arthritis successfully with non-specific vaccines and with proteose, the majority of the typhoids terminating promptly by crisis after the first injection, as did also the cases of acute arthritis. What direct influence this work will have upon chronic aural suppuration remains to be seen, most of the diseases hitherto reported having been acute general infections, but it seems as if the specific theory might be on the verge of an upset which, when once understood, should simplify, rather than further complicate, our vaccine therapy of the future.

TUBERCULOSIS OF THE MIDDLE EAR seems to be coming in for the share of attention and study that it deserves, for it has been greatly neglected in the past. Several observers now claim that, far from being a rare disease, it is not uncommonly found, now that our means for making a diagnosis are more satisfactory. H. B. Graham² thinks that a well-defined clinical picture can now be drawn of this disease so that any trained aurist can make a diagnosis as readily as the internist does. This diagnosis must be based on clinical histories and examinations, pathological sections, presence of tubercle bacilli in the secretion from the ear, which he regards as a rare occurrence, and animal inoculations, which are difficult on account of the mixed infection. Nine cases are presented ranging from two months to forty-five years of age, and from this study Graham supports Siebenmann's statement that the large majority of ear suppurations in youth were of tubercular origin, except that he substitutes "infancy" for "youth." This is deduced from the fact that in children from five to fifteen years of age, ear suppurations are caused by pathological conditions about the Eustachian tube, and promptly cease upon the removal of such conditions; while in infants under one year of age, this does not occur, the discharge persisting after the removal of the adenoids, leading to the conclusion that something other than the adenoid was the causative factor—tuberculosis as he believes. In adults, however, its incidence is much less than in infants, because of the high mortality in these latter cases; spontaneous healing appears to be a rarity, and operative interference not frequently called for. It seems probable that the tuberculous lesions in the ear are directly due to the presence there of the tubercle bacillus and not to a toxin generated in other parts of the body and carried there by the blood. It seems probable also

¹ Journal of American Medical Association, June 3, 1916.

² Annals of Otology, Rhinology, and Laryngology, March, 1916.

that these cases are secondary to pulmonary infections. The bacteria enter the ear, as a rule, through the Eustachian tube and not through the blood or lymph streams, although these routes may be taken at times. It is reasonable to suppose, however, that the bacteria-laden sputum coughed up with explosive force, coats the nasopharynx and must frequently be forced up the tube to the middle ear. If the disease were blood-born to the ear, it would seem that there would certainly be more acute and general miliary tuberculosis among the patients with ear infections, and on the other hand, at least in infants, complete recovery has followed operative eradication of the middle-ear focus.

The anatomic picture of middle-ear tuberculosis varies according to the general condition of the patient, but in general, for classifying purposes, these cases are divided into lesions of the mucous membrane, the drum, and the bone. The process may, however, be general throughout the middle ear, and may then be reclassified into lupoid, infiltrating, fungoid, necrotic, myringitis diffusa, and fibrinoid. There are also the acute and chronic types, and while these classifications may seem complicated, they are logical and will not be found confusing if once understood. Most of the classes just mentioned are chronic in type, and it must be remembered that the clinical picture may change from one to another in the lapse of months or years. The most commonly found forms are the fungoid and the necrotic, appearing most frequently in infants and children, and leading to marked destructive processes, gland involvements, fevers, and paralyses. The fungoid type presents rapidly progressive granulation-forming masses which appear in the middle ear and mastoid without producing much bony change or a great amount of pus. The drum often appears comparatively intact, and the ossicles, when removed at operation, are found covered with granulation tissue. The progress of the disease is rapid, the first symptoms noticed often being those of a mastoiditis.

The necrotic form is more frequently found in adults, and progresses without the formation of the masses of granulations just mentioned. The bony destruction is, however, great, with excessive pus formation, and the antrum and mastoid cells are found filled with a caseous mass and sequestra floating in pus. The fungoid and infiltrating forms may easily pass into the necrotic, but the reverse is not true, the latter remaining pure throughout its course, and not likely to be checked by operation. The infiltrating form likewise is not often successfully operated upon.

The hearing, in these cases, is markedly reduced, and the responses to the tuning-forks resemble those obtained in luetic cases after salvarsan injection, suggesting a possibility of a similar toxic effect on the labyrinth as well as disturbance of conduction. Later on, a complete deafness may occur without any vestibular symptoms having developed, and, on sectioning the labyrinth at autopsy, it may be found totally destroyed and replaced by a caseous or an organized mass.

Facial paralysis is more frequently produced by the rapidly eroding or infiltrating forms than by the simple infections, the lupoid, or the fungoid types. This paralysis in an infant may be the first sign that anything is wrong with the ear.

Graham is rather more optimistic than most observers as to the prognosis, for he believes that in even the most hopeless in appearance there is still a chance of arrest of the local process, while in lupoid cases in adults an early surgical interference should be as successful as in non-tubercular aural suppurations. The necrotic forms in adults usually accompany advanced general tuberculosis, and are not, therefore, encouraging subjects for surgery.

In last year's issue of *PROGRESSIVE MEDICINE* the method of Cocks and Dwyer for isolating tubercle bacilli from ear discharges was given in detail. It was published as a preliminary report, but their final report¹ confirms the claim advanced at that time. Moreover, they discuss the subject of aural tuberculosis and reach conclusions similar to those of Graham. A frequent cause of aural tuberculosis is a tuberculous adenoid, while nasal tuberculosis is regarded as a rare etiological factor.

A rapid onset is the clinical characteristic of the acute forms; multiple small perforations rapidly coalescing into a large defect, rapid formation of granulations, early periotic gland involvement and the early appearance of facial paralysis.

The chronic type is distinguished by its painless onset, protracted course, and resistance to treatment. There is extensive destruction of bone, often leading to facial paralysis. Yearsley is quoted as stating that the tuberculous perforation is usually circular, with a pale, thick or indolent edge, showing no reparative activity, and generally situated in the posterior-superior quadrant. Cocks and Dwyer do not find the perforation in this location. In addition to those mentioned by Graham, they present the following means for making a diagnosis:

1. Staining the aural discharge, excised granulations, or tissue for tubercle bacilli (important and easily done).

2. Microscopic examination of dead bone, granulations, or tissue from the tympanic cavity or mastoid.

3. Excision and examination of periotic glands.

4. The von Pirquet reaction, if positive in children under two years of age, is highly suggestive of aural tuberculosis, especially if no other active lesion is found. This is contrary to the belief of Graham, who finds the tuberculin tests of more value in adults and often misleading in children. Ersner and I found, in 25 cases of middle-ear suppuration, 3 faintly positive and 4 strongly positive von Pirquets, but we were unable to obtain the tubercle bacilli from the discharge. These cases

¹ *Journal of Laryngology, Rhinology, and Otology*, July, 1916.

were mostly adults, and, in one at least, the suppurative condition seemed markedly benefited by the administration of small doses of tuberculin.

5. Tuberculin injections are a valuable diagnostic aid.

6. Animal inoculations, in spite of difficulties, have been the most certain method in the past.

7. A complement-fixation test devised by R. H. Miller may prove an important method of diagnosis.

8. The cytological examination of the pus is worthless. The bacteriological method reported upon last year was the employment of antiformin, which destroys all the common pyogenic organisms, except the acid-fast group. By this method, 9 cases of aural tuberculosis have been cultivated, and, in addition, 6 cases identified by stained smears made by the antiformin method, without culturing.

At one time these investigators examined by these methods all children who came to the clinic, during a certain period, with chronic otorrhea. In these 32 cases the age varied from ten months to fifteen years, and among them were found five positive cultures, showing, according to their figures, that 15.6 per cent. of all chronic purulent otitis media in childhood is tuberculous. This will come as somewhat of a shock to many of us, I think, but it seems fair to assume, from these investigations, that the cultural method is a reliable, accurate, and fairly rapid method of diagnosing aural tuberculosis.

Mastoid. While much continues to be written about acute mastoiditis and its treatment, there is practically no difference of opinion in regard to the simple mastoid operation which can now be regarded as standardized, and even the time at which to operate, while it must ever depend on the individual judgment of the operator, seems to have settled down to a sane position that is not overly radical nor yet unduly conservative. The question of diagnosis still furnishes food for discussion, and prognosticating from the character of the bacterial infection seems to be of value in determining the course the disease is likely to take and consequently how long it may be safe to wait.

A. H. Andrews¹ puts more faith in the examination of a rather thick smear made from the aural discharge than he does in the clinical symptoms, blood count, or bacteriological findings. The smear is immediately dried and fixed with heat, then stained with hematoxylin, washed, dried, and examined by low power. Search is made for particles of bone which appear as very dark or black objects in a comparatively light field. When particles of bone appear in the discharge, it means a breaking down of the cell walls of the mastoid, and is an indication for immediate operation, since resolution cannot occur. Until the cells begin to disintegrate, as shown by the bony debris, there is always a

¹ Illinois Medical Journal, September, 1916.

chance that operation may be avoided, and the surgeon is justified in waiting unless complications call for operation.

To determine this same factor, namely, the beginning disintegration of the bony partitions between the mastoid cells, is one of the chief objects of the röntgenographer, and George E. Shambaugh¹ believes that the skiagraph has a definite value in the diagnosis of mastoid disease, more especially the acute type, as it shows the presence of abscess formation in cases in which no external evidence of mastoiditis is present. It also accomplishes the same object as Andrew's smear, showing the beginning break-down of cell walls and thus differentiating between the type that *may* recover and the type that *must* be operated upon. In chronic cases, however, it will rarely aid in this differentiation, but of course, in these cases, the need of a diagnostic aid is not so obvious.

Harold Hays² agrees with Shambaugh that the röntgenogram is of value in corroborating the clinical evidence of mastoid disease, and considers it of more value than a consultation. It would seem that this latter value would depend somewhat upon the consultant, but in atypical cases, when well taken and interpreted, it is undoubtedly of great service. It gives, in addition, the position of the sinus, the character of the mastoid process, and the extent of the zygomatic cells.

F. J. Putnam³ pleads for an early operation when daily tests and observations show that the disease is progressing or even not improving. I think everyone will agree with him, although they may think that his advice not to wait for a spontaneous cure longer than three weeks can hardly be called radicalism. There is no doubt that longer delay will result in but few more cases added to the unoperated list of cures, while much damage to the hearing and increased danger of intracranial complications may result. Personally, I believe that in a slowly developing or stationary case of mastoiditis with mild symptoms, when we are awaiting a determination to operate or not, and with the employment of all the ordinary routine measures, the administration of bacterial vaccines is justifiable. They should in no case be used as a substitute for operation, or operation deferred to await the result of their employment, but I am convinced that I have seen many slowly progressive cases terminated rather abruptly by this means.

Winckler⁴ holds views at variance with most writers in regard to the involvement of the mastoid in severe acute otitis, basing them on *x*-ray studies. In many cases with profuse discharge he finds the cells perfectly clear at the end, as well as at the beginning, of the inflammation, while in others there is a decided cloudiness, which he has

¹ Illinois Medical Journal, September, 1916.

² New York Medical Journal, June, 1916.

³ Lancet, September, 1916.

⁴ Archiv f. Ohrenheilkunde, vol. xcvi, p. 193.

been unable to observe clear up after the cure of the disease. The *x*-rays, to be of much value, depends upon the disease being unilateral, for contrasting purposes, and the type of the mastoid pneumatic. Cases showing distinct cloudiness in the sinus region, or extending into the pyramid, are to be regarded with caution, even after all symptoms have disappeared, since such cloudiness may denote permanent changes in the mucosa, reparative changes in the diseased bone, or an encapsulated focus of deep-seated inflammation which may again become active.

THE ROLE PLAYED BY THE *STREPTOCOCCUS MUCOSUS CAPSULATUS* in the production of middle-ear and mastoid suppuration has attracted considerable attention from otologists with a leaning toward bacteriology and research, and Winckler is again at variance with most other observers in regard to the frequency and virulence of this infection. In 119 mastoid operations performed between 1907 and 1914 he found the *Streptococcus mucosus* but once in 19 cases over sixteen years of age, while cases due to other forms of streptococci showed the symptoms supposed to be characteristic of the former organism, absence of pain and fever, small amount of serous secretions, an early healing of the middle ear, and subsequently a relapse with light mastoid symptoms. In acute otitis in children, the *mucosus* was found but once in 51 cases, this one being a bilateral mastoiditis. Infection with the *Streptococcus mucosus* is far less common, according to his cases, than would appear from the statistics of other operators. Mark found it present in 4.1 per cent. of his mastoid cases, and Stütz in 13 per cent.

Robert L. Loughren¹ takes the opposite view, and the one generally held, that this organism is a dangerous one whose presence in the middle ear and mastoid lends a grave element of doubt to the prognosis. Its tendency in many cases to produce a very rapid general involvement of the entire bony structure of the mastoid, and also of causing a dangerous and insidious latent period which may justly occasion apprehension of the outcome (Whiting) are recognized by most writers. Experience teaches that it is an infective organism powerful in its ability to produce extensive destruction of bone tissue, and rapid in its action, while its activities may not be confined to the acute stages of the disease. It may lie dormant even during an extended period, during which the process of repair is going on, and at some stage unexpectedly produce an exacerbation that cannot be combated. Loughren, therefore, advises the close bacterial scrutiny of all ear discharges, so that, if found, an early operation may be performed. Furthermore, even after operation and the complete healing of the wound, the prognosis must still be regarded as uncertain for a considerable period of time.

H. O. Reik² describes the IDEAL MASTOID OPERATION, and naturally

¹ Laryngoscope, June, 1916.

² Ibid., February, 1916.

reiterates his well-known views on the blood-clot dressing. He describes the ideal operation (in acute mastoiditis) as one that subjects the patient to the least risk, offers the maximum assurance of cure in the shortest space of time, with the least pain, deformity, or scar formation. This is accomplished by an absolutely complete exenteration of the mastoid, leaving, however, the shell of the tip with its attached tendons in place. Every bit of necrotic or softened bone is removed, even if free exposure of the sinus or dura results, any evidence of bleeding being regarded in the light of infected tissue. The most strict asepsis is demanded in regard to the preparation of the operating room, instruments, surgeon, assistants and nurses, and the patient. This latter is accomplished in the old way, little dependence being placed upon iodine. If secondary sinus infection should occur, it is due to infected bone having been left rather than to traumatism of the sinus in attempting the removal of too much. The average operator usually errs on the side of conservatism and does not take away enough bone. After the thorough cleaning out of the mastoid process and all outlying cells, no chemical sterilization of the wound is attempted, but it is simply flushed with saline solution and allowed to fill with blood, after which it is closed with a subcuticular, silver-wire suture or with the metal clamps.

By this method, 75 per cent. of Reik's patients, operated upon for acute mastoiditis in connection with acute middle-ear suppuration, obtained primary union with complete healing in from five to seven days, with only a linear scar, scarcely visible after a few months, remaining. Of those cases associated with chronic purulent otitis media, in 50 per cent. was primary healing obtained, and even in those in which the clot became infected the healing was more rapid than would have been obtained had packing been resorted to at the outset.

RADICAL MASTOID. In performing a *radical mastoid operation* it has always been the custom of operators to watch, or have the anesthetist watch, the patient's face for muscular contractions when nearing the facial nerve. C. E. Perkins¹ calls attention to certain well-known facts which may be repeated with propriety for the sake of younger operators, dividing these contractions into four types, according to the degree of irritation or destruction caused to the nerve. If the nerve is completely severed, there will be one single contraction involving all the muscles supplied by the facial, and the anesthetist will see that the angle of the mouth and also the muscles about the eyes are equally involved. If the nerve is injured by the instrument, but not completely destroyed, usually by removal of part of the wall of the Fallopian canal by the curet, warning may be given by a succession of facial twitches and a partial paralysis develops which may rapidly become complete. Some cases by reason of a developmental anomaly, or

¹ Annals of Otology, Rhinology and Laryngology, September, 1915.

destruction of the bony walls of the facial canal, present the bare nerve to the surgical field, and probing or pressure sponging will cause facial contraction, as will also traction on the chorda tympani nerve.

The *end-results of the radical mastoid operation* are commented upon by S. MacCuen Smith,¹ whose paper and the discussion which followed may be taken as the present opinion of the profession in America in regard to this procedure. According to the experience of the author, the operation is a very satisfactory one, most of his patients having entirely recovered with dry ears, and none having died except when the operation was undertaken for the relief of some existing intracranial complication. When suppuration persisted, it was of the intermittent, recurrent type due to tubal reinfection. The average time necessary for after-treatment in 334 cases was about three months for ward cases who frequently attend very irregularly for treatment. In private cases it is very much less, even without skin grafting, which the author has not employed successfully until recently. Cessation of discharge was obtained in 80 per cent. of ward patients and in about 95 per cent. of private cases, the discrepancy being due, as stated above, to the frequent neglect of the former class to care for themselves. No intracranial complications developed as a result of the operation, although many cases of unsuspected intracranial or labyrinthine involvement were discovered at the time of the operation.

If the functional activity of the internal ear remains unimpaired, hearing should be as good as before operation. In 32 per cent. of the cases hearing was improved, in 49 per cent. it remained relatively the same, in 11 per cent. the hearing decreased after operation, and in 8 per cent. no record existed. We are therefore justified in saying that the operation is not likely to result in impaired hearing. Paralysis should be, and is, infrequent in expert hands, although now and then a case will occur. Some of these cases will recover, but others remain permanently paralyzed.

While the radical mastoid operation should be regarded as a major procedure, especially when the opportunity for causing irreparable damage is considered, yet the operation is not only safe in competent hands, but is usually productive of the maximum amount of good, and is therefore wholly justified.

It will be instructive to abstract some of the discussion of this paper.

A. B. Duel said there were two distinct types of diseased mastoid requiring radical operation: In one the life of the patient was threatened, and in the other there was only an annoying discharge to be cured. Naturally, the end-results of these two classes would be different, especially in regard to the length of time required for healing. In those cases in which healing was obtained in five or six weeks, the surgical

¹ Transactions of American Laryngolog., Rhinolog. and Otolog. Society, 1915.

condition consisted simply in a mass of granulations without bone necrosis. When that was present, cases would require from eight or ten weeks to a year before a dry ear was obtained, and cases of cholesteatoma could not be considered cured until two years had elapsed. Duel practises secondary skin grafting in the third week after operation, and after the cavity has become covered with granulations, believing it much safer.

E. B. Dench, on the other hand, believes in primary grafting, thus obtaining complete cures in as short a time as ten days and two weeks. He objects to the second anesthetization necessary for the other method, and has never seen any danger from his procedure. Neither does he agree with Duel in regard to the two classes that come for operation, since he regards every individual with a running ear in danger. If hearing was very poor, it would probably be increased after operation. If hearing was moderately good, it would remain the same; while if it was very good, it would probably become worse.

Joseph C. Beck classifies diseased mastoids into five distinct pathological conditions, which influence the rapidity of the healing process: (1) Fibrosis of the bone; (2) fibrosis with fistula of the mastoid bone; (3) cholesteatomatous infiltration through the trabeculae; (4) tuberculous osteitis; (5) syphilitic infiltration. The finding of one of these conditions would enable the operator to predict the length of time required for healing. For instance, cases of simple fibrosis heal very rapidly, while those of syphilitic fibrosis respond very slowly, without vigorous systemic treatment.

James E. Logan finds, in cases in which a thorough radical operation has been performed and the suppuration still continues at intervals, that a thorough cleaning out of the vault of the pharynx will cause most of them to cease. Frank Allport finds very good hearing in the majority of his patients after operation. His after-treatment differs somewhat from that of others, as he discards gauze packing after a few days, and, instead, fills the cavity with boracic acid powder. By this method healing will take place in a much shorter time than by any other if the vault of the pharynx is cared for as mentioned by Logan.

Thomas J. Harris thought there was another side than the favorable one that had been brought forward by all the speakers. In every large clinic many cases could be seen with facial paralysis and with ears that required constant dressing for very long periods of time without cessation of discharge. He therefore asked whether it was fair to consider this operation solely from the results of brilliant operators, or should it not be considered from the view-point of the majority. There was a feeling that the radical operation was being overdone and that it was done too quickly.

II. J. Marriage¹ firmly believes in applying a Thiersch graft at the

¹ Journal of Laryngology, Rhinology and Otology, March, 1916

time the operation is performed, and finds the following advantages for the method:

1. The cavity heals much more quickly than by any other method.
2. Contraction of the cavity and stenosis are prevented, and at the same time there is no possibility of granulations extending across various parts of the cavity, and so shutting off cavities which remain unhealed and cause persistent discharge.
3. The patient is spared a large amount of pain which formerly was caused by firmly plugging the raw surface of the mastoid cavity.
4. Both the patient and surgeon are saved much time and trouble, as about ten days after the grafting operation the patient is able to do nearly all that is necessary for himself and only see his surgeon once a week; and the patient is thus able to return to work much earlier than though he was obliged to attend daily for treatment.
5. The surgeon is not worried by having to make complicated meatal flaps, many of which cause much deformity of the concha, and when made are often difficult to keep in position, as all that is necessary is to remove sufficient of the posterior meatal wall to ensure easy access to the antrum and mastoid cavity.
6. In a large proportion of cases the Eustachian tube is closed, and reinfection, *via* the tube, is thus prevented.

The objection to skin grafting which is often made is the impossibility of making the wound aseptic. This in practice makes no difference, as in 99 cases out of 100 the graft takes well, and in the hundredth, islands of skin are left from which epidermatization of the cavity quickly proceeds. The hearing is at least as good as when grafting is not performed, but the cavity is liable to become filled with cerumen and epithelium which must be removed once or twice a year.

Marriage employs the primary skin graft in all cases except those of acute disease when it is necessary to do a radical operation, when he prefers grafting subsequently. The advantages of the primary graft are that from seven to ten days are saved in convalescence and no second anesthesia is required.

The method followed is to thoroughly clean out the middle ear and mastoid, exposing the dura if necessary, cut a meatal flap to widen the external canal, scrape out all the mucous membrane of the tympanum, except a very small margin around the stapes, and to curet the Eustachian tube. To check bleeding and disinfect the cavity, hydrogen peroxide (20 volumes) is poured in, left for two or three minutes, and washed out with saline solution, this to be repeated three times. The cavity is then plugged with gauze while the graft is being cut from the thigh. This graft is placed in position by means of the Ballance suction apparatus and kept in place by the insertion of a strip of aristol gauze. The end of the gauze is brought through the meatus as is also the free end of the graft, so as to cover the cut meatal edge. The ear is sutured

in place. The dressing is left untouched for four days when it is withdrawn and the cavity syringed with weak hydrogen peroxide solution, and a small gauze drain inserted. This treatment is continued daily for one week when all packing is stopped and plain hydrogen peroxide (10 volumes) is dropped in twice daily by the patient. Small areas of excessive granulations are touched with silver or scraped, and the superficial part of the graft gradually separates, and usually comes away when the ear is syringed, but it may be necessary to remove it with forceps. When the cavity is nearly healed, rectified spirit is instilled to harden up the skin surface.

J. S. Fraser¹ makes his initial incision back of the hair line so that the line of incision, when sewed up, comes over solid bone and not over the newly formed cavity where it is much more apt to separate. His technic in regard to cholesteatomatous cases is different from the general teaching in that he does not remove the matrix, because, if this is left *in situ*, it greatly assists in epidermatizing the cavity, since cholesteatoma consists of squamous epithelium, and this is what we hope to line the cavity with. A little extra care in the after-treatment is needed, but in this respect he says it is absolutely necessary to impress on all patients on whom "the radical operation has been performed that they must have their operated ear attended to at least once a fortnight, and better still once a week for the rest of their lives." I am afraid that this result would hardly be classed as a "cure" in America.

Fraser believes it very important to make a large external meatus by extending the incision for the plastic well into the concha and stitching back the flap, as the cavity tends to remain moist if the meatus is too small. While this may not be disadvantageous as far as hearing is concerned, both patients and surgeons prefer a dry ear. To prevent drooping of the auricle, a crescentic piece of skin is cut out from the upper and posterior part of his curved, retro-auricular incision.

This is about one inch long and one-quarter inch wide at its broadest part. The removal of this piece tightens up the auricle and holds the external canal straight. The crescentic piece of skin is preserved, thinned out by removing all subcutaneous tissue, and applied as a graft to cover the facial spur, from which, the author observed, granulations were very prone to spring, sometimes almost reforming the posterior wall. The graft is applied to the facial spur, after thorough cleansing of the cavity, and covered with an oblong piece of oiled silk slightly larger than the graft itself. These are packed in position with iodoform worsted, which remains until the fifth day. The oiled silk will retain the graft in place even after the withdrawal of the packing and the graft invariably retains its position. Healing may be complete in six

¹ Journal of Laryngology, Rhinology and Otology, March, 1916.

weeks. The need of skilful after-treatment of the radical cavity is strongly emphasized. The first dressing is done on the fifth day, the second on the seventh and daily thereafter until the tenth, when the packing is omitted during the day time, and only a light wick placed in the canal at night, to maintain the patency of the meatus. In some cases, however, and they are long and tedious ones, the packing method has to be continued.

Development of the work of Barany is constantly adding to our knowledge of the symptomatology of the labyrinth and of intracranial lesions which, in conjunction with the neurological and ophthalmological examination, can often be diagnosed with accuracy as determined by operative and postmortem findings. And these tests are of further usefulness in completing our knowledge of the nerve impulse

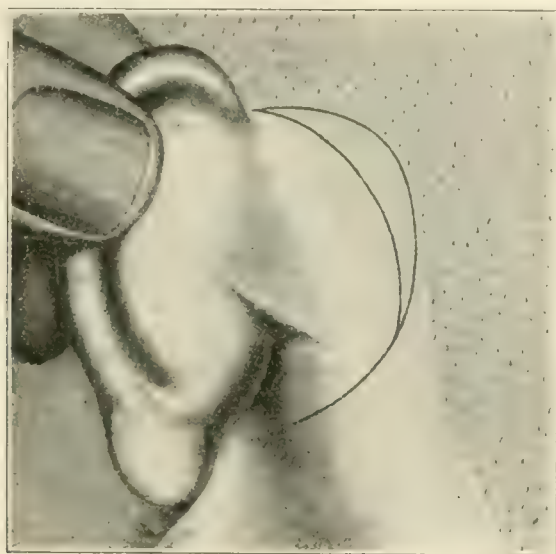


FIG. 23.—Lines of incision for outlining skin graft (left ear). The crescentic piece of skin is left attached to the periosteum, and the flap in front dissected up subcutaneously as far forward as the retro-auricular groove where the incision is made through the periosteum down to the bone.

pathways in the brain. Charles K. Mills and I. H. Jones¹ report an interesting case which seems to confirm some of their postulates concerning these matters and especially their contention that there is a *neuraxial differentiation of the fibers of the horizontal and the fibers of the vertical semicircular canals*. They call attention to the fact that wherever the primary cause of vertigo may lie, vertigo itself is not produced until the labyrinth is involved, and that the Barany tests furnish the means of studying this vestibular apparatus. While it has been shown histologically by Cajal that fibers of the vestibular portion of eighth nerve enter Deiters's nucleus and continue through the inferior cerebellar peduncle into the cerebellum itself, they believe that this

¹ Journal of American Medical Association, October 28, 1916.

path only includes fibers from the horizontal canals, and that the fibers from the vertical canals have an entirely different course, ascending into the pons, while the former are confined to the oblongata. If this contention is correct, and I believe I have seen it demonstrated, we can easily see that it can be utilized for the more accurate placing of intracranial tumors, since the canals are susceptible of individual stimulation by the combined turning and caloric methods. In 32 cases of Mills and Jones in which the labyrinth and eighth nerves were normal and the horizontal canals gave normal reactions, the vertical canals failed in some, or all, of the well-known responses. In 5 cases stimulation of the vertical canals produced no nystagmus, vertigo, past pointing or falling, but projectile vomiting occurred, thus showing that the vertical canals were functioning and that there was even a hyperactive response of the tenth nucleus to the stimulation of the canals.

From the study of these cases, the authors believe that the ear stimulus which produces vertigo passes to the cerebrum through the *cerebellum*, and while all the paths which carry these stimuli through the cerebellum are not absolutely demonstrated, it seems to be indicated that they are received by the cerebellum through the inferior cerebellar peduncles from the horizontal canals, and through the middle cerebellar peduncles from the vertical canals, and, after traversing the cerebellum, pass to the cerebrum through the superior cerebellar peduncles. In the case reported, ear stimulation failed to produce vertigo from all the semicircular canals except the left verticals, indicating that there was obstruction somewhere in this vestibulo-cerebello-cerebral pathway concerned with the stimuli causing vertigo. As there was present a conjugate deviation from stimulation of the same canals or tracts, the lower neuraxial pathways appeared open. To explain this absence of vertigo, the logical place of destruction would be at the decussation of the superior cerebellar peduncles, and necropsy studies showed those peduncles involved which have been demonstrated to contain tracts passing from the cerebellum to the cerebrum. Mills and Jones state, from their experience in the study of these cases, that spontaneous upward nystagmus is pathognomonic of a neuraxial lesion, either destructive and due to pressure. Interruption of the impulse from the canals is due to tumors of the cerebellopontile angle, internal hydrocephalus causing pressure on the floor of the fourth ventricle, and intracerebellar tumors pressing on the pons.

E. J. Moure¹ has a simple but practical *test for the functional capacity of the vestibular labyrinth*, based upon a children's game. It consists in turning the individual under examination six times around a stick on which he rests his head. He then opens his eyes and attempts to

¹ Revue de laryngology, d'otology et de rhinology, August 31, 1916.

walk straight forward. If normal, he will be unable to do so, but will deviate or even fall in the direction of the turning, while if the labyrinth is impaired he will be able to walk without being affected.

Internal Ear. Some confusion exists in the minds of many aurists in regard to the classification of labyrinthine disease, since most authors adopt a system of their own. Until we, from a further study of inflammatory conditions of the inner ear, can standardize our pathology as that of the middle ear has been standardized, we cannot agree upon a classification as has been done in the middle ear, though it would seem probable that a very similar one could be adopted. Until that time, all suggestions should receive attention and consideration. John B. Rae¹ offers a somewhat new classification as follows:

1. Acute diffuse labyrinthitis.
2. Chronic diffuse labyrinthitis.
3. Perilabyrinthitis or paralabyrinthitis with fistula.
4. Perilabyrinthitis or paralabyrinthitis without demonstrable fistula.

This classification has the advantage of simplicity but does not seem, at first, quite definite enough. Evidently class No. 1 has to be subdivided into serous and purulent types. It occurs during the course of an otitis media, either acute or chronic; when the former, it is usually a metastasis with empyema of the labyrinth, but, when the latter, it is due to an extension of bony caries. The onset of both is sudden, with vestibular symptoms, nystagmus to the affected side and a very sick patient—too sick for labyrinth testing. If the nystagmus suddenly switches to the uninvolved side, it means probable destruction of the end-organs on the diseased side, and the tests can now be made without discomfort. Loss of hearing is most marked, and the diagnosis between serous and purulent disease depends on whether this is regained or permanently lost, this being made, not on the evidence during the illness, but upon the result. An acute diffuse suppurative labyrinthitis becomes chronic on the passage of the acute stage, passing gradually from one to the other, and often remaining undiscovered for a long time. The patient is deaf, with much shorter after-nystagmus to the diseased ear.

Paralabyrinthitis with fistula is the result of a slow erosion of the capsule by a chronic middle-ear suppuration, usually accompanied by cholesteatoma. The slow formation of the fistula permits a walling-off process which limits the diseased area, and it might be called a limited end osteitis. Of course, the most common locations are, in order of frequency, the horizontal canal in the aditus, the neighborhood of the round window, and the promontory. The fistula test is not always positive, since the fistula may be covered with granulations. I might also add in parenthesis, that the labyrinth may be "dead" and in that case also there will be no response.

¹ New York State Medical Journal, August, 1916.

In paralabyrinthitis without fistula, the labyrinth is not distinctly diseased, the symptoms being due to pressure upon the diseased capsule by disease in the mastoid.

As to the *indications for the labyrinth operation*, which are not yet classified to the satisfaction of all surgeons, Charles E. Perkins¹ makes some interesting comments, illustrated by 3 cases of his own on whom the operation was performed. While there is practical agreement among aurists that circumscribed purulent labyrinthitis (which is not according to Rae's classification) must be left severely alone, except for the performance of the radical mastoid operation, and while no one knowingly does a labyrinth operation for diffuse serous labyrinthitis, it is possible that it may be done at times on the supposition that it is purulent. If a fistula, in circumscribed labyrinthitis, is disturbed with probe or curet, the process is extremely apt to become general, with most disastrous consequences. In diffuse serous labyrinthitis the question is complicated by our present inability to always make a positive differential diagnosis between this disease and the suppurative process. It seems safer, on the whole, in such a case, to drain the labyrinth rather than take the chance of ultimate meningitis following an undiagnosed suppuration.

Surgeons are divided in opinion as to the indications for operation in the manifest stage of diffuse purulent labyrinthitis, one group opening and draining every such labyrinth, while the so-called conservatives operate only when meningitis occurs, or seems imminent. The former probably operate upon a good many patients who might recover without interference, while the latter allow many patients to die, who might live if operated upon promptly. As the spinal fluid gives evidence of the approach of meningitis before there are any clinical manifestations of the disease, anyone treating a manifest form of purulent labyrinthitis expectantly should have lumbar punctures made at regular and frequent intervals, and remove the labyrinth at the earliest indication of complications, for if he waits for fever and headache, the chances for success will be very much reduced.

The writer believes, from the experience gained from the 3 cases reported, 2 of whom died, that every suppurating labyrinth should be drained by opening the vestibule and removing the promontory as soon after the diagnosis is made as possible. If meningitis has already developed, this operation will be insufficient, and that of Neumann must be performed, securing drainage of the subdural space at the internal auditory meatus, and expose for incision, if necessary, the dura of the middle and posterior fossæ.

There are three types of latent diffuse suppurative labyrinthitis. One is where the causative middle-ear process has healed and needs no

¹ Laryngoscope, July, 1916.

treatment. The hearing is irrecoverably lost, and there is little danger of meningeal infection. Another class is where the middle-ear process is active and calls for operative interference. The outcome of such interference is rendered much graver because of the existing suppuration of the labyrinth, since barriers may be broken down by the trauma of the mastoid operation. It seems safer, when the radical mastoid operation must be done in this type of case, the labyrinth being, of course, dead, to open and drain the latter as a precautionary measure. Some even advocate the removal of the posterior surface of the petrous pyramid to the internal auditory meatus, opening and draining the subdural space there. In some few cases the labyrinth suppuration is a healed process, the spaces being filled with fibrous tissue and new bone. Ruttin demonstrates this condition by showing good "compensation" in the application of the rotation test. Thus, if one labyrinth can be showed to be destroyed by absence of reaction to the caloric test and total deafness, and if rotation with the head erect gives after-nystagmus in either direction about equal, of ten or twelve seconds' duration, compensation has taken place and one may assume that the condition in the labyrinth is a healed process, and that the radical mastoid operation can be done, and the labyrinth need not be opened. The third class comprises those cases in which there is necrosis of the labyrinthine capsule, either as a fistula leading to a dead labyrinth, or as a sequestrum. The indication here is plainly to remove the dead bone and afford adequate drainage.

The new conception of *vertigo* is set forth by Jones and Fisher,¹ who offer the dictum that *all vertigo, of whatever cause*, is a peculiar and definite disturbance perceived within the brain just as sight and hearing are perceived; and that the vertigo impulses are transmitted thereto through the vestibular portion of the ear and its associated paths. Perfect equilibration is accomplished through harmonious coöperation of the special senses (chiefly the static, sight and muscle senses) and disturbance in any one of them will result in partial or complete loss of equilibration (vertigo). By vertigo is meant a subjective sensation of a disturbed relationship of one's own body to surrounding objects. Stimulation, irritation, or destruction of the labyrinth, or of any portion of the vestibular tracts, induces vertigo, or dizziness associated with loss of equilibration. Irritation of the ear itself is not, however, the sole way of producing vertigo. The point is made that the vertigo of disturbances of vision, gastric and alimentary disorders, etc., is due to their direct action on the static labyrinth which, in turn, is responsible for the production of the vertigo. Should the pathological condition fail to irritate the vestibular tracts, there will be no vertigo. The vertigo produced by inflammatory or other conditions of the ear itself

¹ New York Medical Journal, July 15, 1916.

can be differentiated from other kinds of vertigo by an examination of the ear, both the cochlear and vestibular portions.

The analogy between the reaction of induced vertigo and seasickness is marked, as is the similarity of the cause, but, unfortunately, the treatment is limited. Experimental vertigo manifests itself in three planes, namely, horizontal, frontal and sagittal, depending upon the semicircular canals stimulated at the time. In seasickness we have such a stimulation caused by the movements of the vessel, but these movements are complex and impossible to analyze, for we have rolling and pitching, besides innumerable combinations of these two. The position of the patient in relation to these movements would also complicate the picture, so that it is probable that there is excessive intermittent stimulation of all the canals. Now in induced vertigo it is only necessary to place the canals causing the vertigo in the horizontal plane to be relieved of the unpleasant sensation of falling. While relief in seasickness can be obtained by lying down in different positions, it is manifestly impossible, with these multiple and complex stimulations, to counteract all at the same time.

In considering vertigo, we must remember that the static labyrinths always act in unison, and are continuously sending out tonic impulses to the whole body. When any pathological process impairs or exaggerates the action of one labyrinth, there is disharmony at once produced, with vertigo as a symptom. Impairment or stimulation of both sides to the same extent will not produce vertigo.

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